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JANUARY, 1925

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American Journal of Diseases of Children

VOLUME 29 JANUARY, 1925 NUMBER 1

ENERGY METABOLISM OF NORMAL NEW-BORN BABIES

WITH SPECIAL REFERENCE TO THE INFLUENCE OF FOOD AND OF CRYING *

JOHN R. MURLIN, PH.D., RUTH E. CONKLIN, M.S.
AND
M. ELIZABETH MARSH, M.S.
ROCHESTER, NEW YORK

INTRODUCTION

Two of the most important problems yet to be solved regarding the energy metabolism of new-born infants are: (1) the reaction to food, that is, the amount of the specific dynamic action of food; and (2) the effect of crying on the energy exchanges. The present study represents an attempt to assemble data on both of these problems.

Very few observations on the dynamic action of food in new-born infants have been recorded. Nearly all that we know about this subject in infancy has been learned from subjects which were at least 4 weeks of age. To review this knowledge very briefly, it may be recalled that Rubner and Heubner [1] were of the opinion that they had demonstrated a dynamic effect of cow's milk in the case of their second normal infant, aged 7½ months, because this infant on a diet containing 44 per cent. more than its maintenance requirement in the form of cow's milk, showed a metabolism of 9.7 per cent. higher than their normal breast fed infant which was 9 weeks of age. Twenty-five years ago the influence of age on the basal metabolism in infancy had not yet been established, and it is quite certain that a portion if not all of the difference noted by Rubner and Heubner was due to difference in age. It is unnecessary here to criticize this older work, further than to point out that the method of determining energy metabolism on the basis of all day observations is now obsolete, that the older work contained no record of muscular activity of the child, and finally that Rubner's conception that the food intake in twenty-four hours must be greater than

* Received for publication, Oct. 30, 1924.

* From the Department of Vital Economics of the University of Rochester and from the Obstetrical Division, Highland Hospital.

1. Rubner, M., and Heubner, O.: Ztschr. f. Biol. **38**:315-398, 1899.

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the maintenance requirement for the same time in order to show the dynamic effect has, since the classic work of Lusk, been revised to signify rather that the inflow of digestive products into the circulation need only be more rapid than the momentary need in order to show a dynamic effect. At least this seems to be the explanation of the effects of carbohydrate and fat if not of protein. What Lusk calls plethora metabolism means simply that fuel is added to the fire. No further explanation seems to be necessary except in the case of protein, and even here it is extremely difficult to distinguish between a true stimulating effect and the effect of deaminized protein as fuel.

Howland [2] was the first to prove the dynamic action of protein in infants. When he added 4 gm. of nutrose containing 14.2 per cent. of nitrogen to each of three feedings with his first subject, aged 3 months, there was an increase of 10 per cent. in the heat production. Adding 30 gm. to the food of a child, aged 7 months, gave an increase of 26 per cent. Hoobler [3] following up the work of Murlin and Hoobler [4] in the case of a child, aged 3 months, was able to carry the dynamic effect of protein in the form of albumin milk to the colossal figure (for the human being) of 42 per cent.

For fat the reaction is not by any means so incisive. Indeed there have been no studies directed especially to this question of the dynamic action of fat in infants. Niemann [5] witnessed an increase in the metabolism of one underweight infant, aged 4 weeks, from 1,337 to 1,443 calories per square meter (Meeh) in twenty-four hours when the caloric intake was increased 67 per cent. by the addition of 200 calories of fat. However, this was reckoned on the twenty-four hour basis and does not by any means represent the maximum effect of fat to increase oxidation. Murlin and Lusk [6] demonstrated in the dog an increase of 30 per cent. at the sixth hour, after feeding 75 gm. of emulsified fat. Fat in the same physical condition given to infants in proportional amount, doubtless would raise the metabolism more than was witnessed by Niemann with the twenty-four hour method.

The information regarding the dynamic action of carbohydrate in infancy is even more meager. All that can be gathered from the literature is that probably sugar of milk stimulates the metabolism very little, but that cane sugar and dextrose stimulate more.[7] Exact figures cannot

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2. Howland, J.: Ztschr. f. physiol. Chem. **71**:1, 1911.

3. Hoobler, B. R.: The Protein Needs of Infants, Am. J. Dis. Child. **10**:153 (Sept.) 1915.

4. Murlin, J. R., and Hoobler, B. R.: The Energy Metabolism of Ten Hospital Children, Am. J. Dis. Child. **9**:81-119 (Feb.) 1915.

5. Niemann, A.: Jahrb. f. Kinderh. **74**:22, 237, 650, 1911.

6. Murlin, J. R., and Lusk, G.: J. Biol. Chem. **22**:15, 1915.

7. Benedict, F. G., and Talbot, F. B.: Pub. 201, Carnegie Inst., Washington, 1914.

be quoted, for the effect of carbohydrate in infancy has not been studied under controlled conditions. It was with special reference to the effect of this foodstuff that the present study was undertaken. Incidentally, some interesting data on the effects of crying definite lengths of time have been gained.

METHODS

Apparatus and Improvements.—The apparatus used in these experiments is the respiration incubator, described by one[8] of us several years ago, ventilated by means of the Benedict Universal respiration machine. A few improvements have been made in the apparatus since it was originally described. In determining the oxygen for each separate period, it is necessary to know the exact temperature of the air inside the respiration chamber at the beginning and at the termination of each period. Mercury thermometers have been used hitherto for this purpose, but at times when the infant suddenly became restless or stopped crying near the end of the period, it was suspected that a considerable lag in the mercury column was responsible for obvious inaccuracies. For this reason four electrical resistance thermometers connected in series, were placed inside the chamber on different walls and were used by means of a wheatstone bridge and galvanometer to secure more accurate observations of rapid changes in temperature. The lag in the mercury thermometers was thereby confirmed. We continued to use mercury thermometers, however, in the incoming and the outgoing air and seemed to obtain somewhat better control in check experiments. When the temperature as indicated by these mercury thermometers was averaged with the reading obtained on the galvanometer from the resistance thermometers, it was found that the resistance thermometers responded quickly to changes in air temperature caused by crying or by mere restlessness on the part of the child.

A second improvement in the apparatus consisted in the introduction of valves in the two trains of absorbers for equalizing differences in pressure in the two trains. The advantage of having these pressures equal is that a period may be terminated without stopping the blower. The valves in question are shown in the illustration. It will be readily appreciated that restricting the flow of air by means of one of these valves will have the effect of lowering the spirometer on top of the respiration chamber. Sudden closure of one of these valves obviously would be disastrous, for the blower would continue to draw air out of the box and no air would return to take its place.

Each time the absorbers were refilled with soda lime and sulphuric acid, it was found that the pressure was somewhat different than before. In order to equalize the pressures on the two sides it was only necessary to throw the valves, closing one side and opening the other, back and forth, after starting the blower. The side which showed the lesser resistance to the inflow of air back to the respiration chamber from the absorbers, could be throttled down by cautious movement of the valve on that side. After a few trials throwing the lever back and forth, and adjusting the valves it would be found that the spirometer did not move on switching the air from one set of absorbers to the other. It became a routine practice to equalize the pressure in this manner each day before starting the experiment.

A third change in the apparatus concerns the absorption system. In running oxygen checks it had been noted that the moisture lost from the soda lime jar was not completely absorbed by the sulphuric acid bottle. This discrepancy was great enough to produce a considerable error in the oxygen check. A second absorber was therefore introduced after the sulphuric acid bottle, and different chemicals were tried as a means of removing the last trace of moisture.

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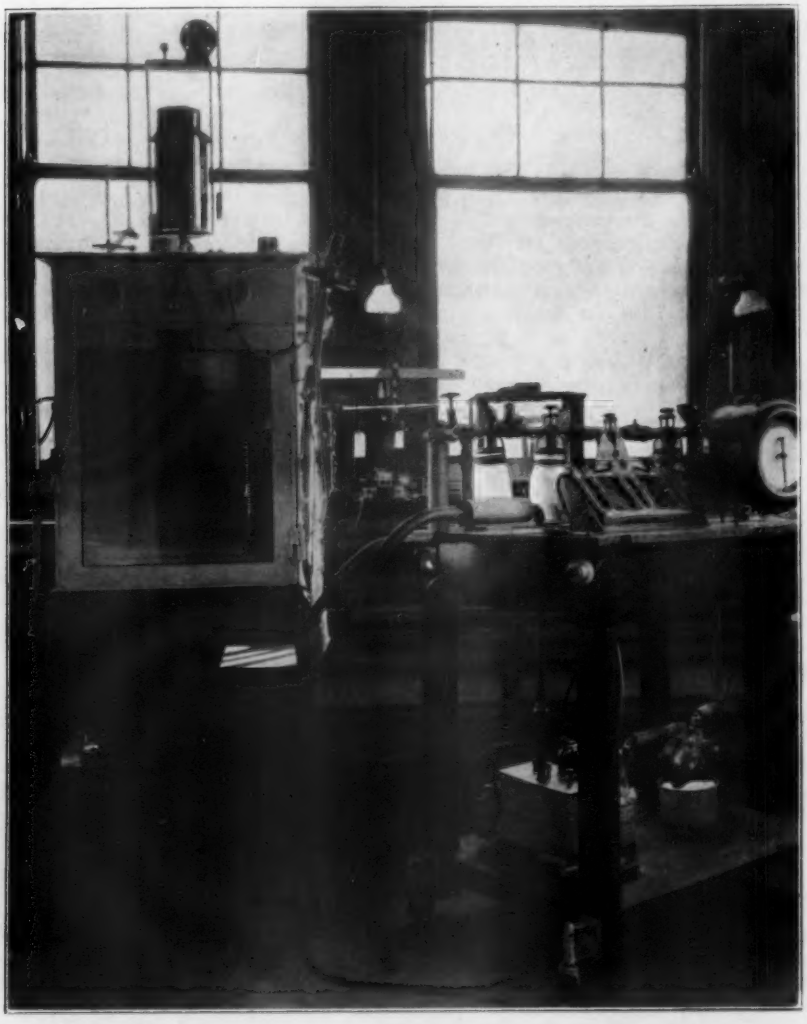
8. Murlin, J. R.: A Respiration Incubator for the Study of the Energy Metabolism of Infants, Am. J. Dis. Child. **9**:43-58 (Jan.) 1915.



General view of the respiration incubator. The air current passes from left to right through the water absorbers (on the lower shelf) and from right to left through the carbon dioxid absorbers (on top of table). The phosphorus pentoxid bottles of the two sets of carbon dioxid absorbers are shown at the extreme left. Above these are seen the regulating valves by which the pressures in the two systems are equalized. The residual system (three U-tubes and meter) are seen in front on top of the table. The small oxygen cylinder with reducing valve hangs on the right upper corner of the front part of the incubator. The spirometer and magnet on top of the incubator regulates the inflow of oxygen. The galvanometer and wheatstone bridge are to be seen between the incubator and the absorber table. The cradle is to be seen (dimly) through the glass doors of the incubator.

Phosphorus pentoxid proved to be the most efficient. It was therefore introduced as a second dehydrating agent, following the sulphuric acid bottle. Since October, 1921, the train of absorbers has consisted of one soda lime jar, one sulphuric acid bottle and one phosphorus pentoxid bottle. To avoid any possible loss by spray of phosphorus pentoxid, glass wool was loosely packed in the outlet tube, and to avoid any possible transference of acid fumes to the child the moisture chamber immediately following the phosphorus pentoxid bottle was filled with a sponge partially saturated with a weak solution of sodium hydrate.

Check Experiments.—In addition to the routine tests for tightness in the whole system, checks were regularly made by burning alcohol in the chamber and getting both the relative and absolute amounts of oxygen utilized and carbon dioxid given off. The result of these tests, taking good and bad from the beginning to the end of the series, shows an average error of 1.8 per cent. in the respiratory quotient with practically theoretic carbon dioxid. The larger error on the oxygen is in accordance with the experience of other observers with this type of apparatus and was expected. Even with residual analyses of the air, which were always made at the beginning and end of each period and with electrical measurement of the temperatures, we have not been able to entirely eliminate the oxygen error. We are convinced that it is attributable in the main to errors in reading temperatures; for when oxygen checks are run after the manner described by Williams[9] in his standardization of the Cornell calorimeter, the error on the oxygen was even greater. This method imposes a very severe test on an apparatus which is not entirely adiabatic and which is not surrounded by a perfectly uniform temperature. The procedure consists in raising the temperature of the chamber air a degree or two above that of the room air and running a period as usual while the temperature falls. The oxygen actually put into the chamber to replace the shrinkage in volume due to cooling should agree with the calculated reduction in volume from the changes in temperature, barometer if any, residual analyses and weight of absorbers. Table 1 is an example of such checks.

TABLE 1.—*Oxygen Checks*

Temperature Drop, C.	Oxygen Measured Liters	Oxygen Calculated Liters	Difference Liters	Percentage of Error
1.53	0.417	0.423	—0.006	—1.4
0.73	0.180	0.171	+0.009	+5.3
1.35	0.226	0.217	+0.009	+4.1

It is quite probable that the error on measurement of the oxygen in an actual observation with the infant is never so great as 5 per cent., for the fluctuation in temperature of the chamber from the beginning to the end of a period was never over a few tenths of a degree even when the room temperature varied several degrees.

We agree with Talbot and Moriarty[10] as to the importance of a constant room temperature, but the room at the hospital in which our work was done was so exposed as to make a close regulation impossible. The respiration chamber is nearly completely insulated from the direct effect of room temperature, but the air in the absorbers was often several degrees below that in the chamber, and most of our errors on oxygen we believe are traceable to this cause.

9. Williams, H. B.: J. Biol. Chem. **12**:317, 1912.

10. Talbot, F. B., and Moriarty, M. E.: J. Lab. & Clin. Med. **7**:91 (Nov.) 1921.

We have not observed the differences reported by Talbot and Moriarty due to changes in the level of the spirometer. It has always been our custom to keep the spirometer bell only a couple of inches above its lowest point, and the oxygen feed is regulated automatically at this level.

Record of Movement and Pulse.—The necessity of knowing the amount and the character of the activity of the infant during the period of observation was first recognized by Schlossmann[11] and by Benedict,[12] who both devised methods for measuring it. We have combined the direct observation method of the former with the spring bed method of the latter. The bed on which the infant rested was attached to a support by special springs, and a pneumograph was securely fastened to this support and to the swinging bed. A fairly heavy rubber tube led from the pneumograph inside through the walls to a writing tambour outside. Attached to the tambour was a lever with a writing point resting on a revolving drum. The slightest movement of the child caused an elongation of the pneumograph with changes in the air pressure within the tambour and, in consequence, a vertical mark on the drum. The intensity and the extent of the activity were both recorded.

In addition, a stethoscope was fastened to the infant's chest with adhesive strips. A tube from this led to the outside, earpieces were attached and a nurse took the pulse rate every five minutes, and kept an activity record also of the kind, extent and duration of the activity whether crying hard, fretting, or only moving its limbs. From a comparison of the graphic record and the nurse's record, very exact information was obtained as to the activity of the child.

The evaluation on a numerical basis of the record of muscular activity of the infant has not been adopted, because of the inevitable variations in distensibility of the rubber parts, tambour membrane, pneumograph and tubing employed, variations in the springs on which the bed was suspended as well as in the weight of the subject, and variations in the magnification of the recording lever, resistance of smoked surface and so forth. Because of these several variations, the sensitivity of the recording mechanism could not be kept constant. When two of us undertook to make numerical evaluations of the graphic records, the agreement was not very satisfactory. For this reason we have adopted symbols indicating a true basal condition, i. e., complete muscular repose throughout the period, crying, fretting and other movements. These symbols are explained in Table 2.

Procedure.—Because of the inherent difficulty of obtaining complete muscular repose in the infant without food, we have followed the custom previously adopted[13] of taking as basal the metabolism during quiet sleep soon after feeding. As a routine procedure the infant was weighed, fed and weighed again immediately after, the gain in weight being recorded as the amount of food ingested. Sometimes this record was falsified by regurgitation subsequently, but in all cases where the amount of feeding is given in the tables it denotes the amount actually retained.

Immediately after weighing, the child was placed on the swinging bed, the stethoscope was attached to its chest wall, the bed pushed into the chamber, the stethoscope and pneumograph tubes connected, and a preliminary period was run of sufficient length to allow a lapse of at least thirty minutes between the time of feeding and the beginning of the first period. By this time, if perfectly comfortable, the child would be sound asleep.

The temperature inside the chamber in different observations varied as a rule between 24 and 28 C., depending on the season of the year, but in one or

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11. Schlossmann, A., and Murschauser, H.: Biochem. Ztschr. **26**:14, 1910.

12. Benedict, F. G., and Talbot, F. B.: Some Fundamental Principles in Studying Infant Metabolism, Am. J. Dis. Child. **4**:129 (Sept.) 1912.

13. Bailey, H., and Murlin, J. R.: Am. J. Obst. **71**:526, 1915.

two instances it was as low as 22, and once reached 29 C., but the coverings placed over the infant varied accordingly so that it slept comfortably.

Calculation of Results.—The oxygen absorption by the child was determined by weighing the small oxygen cylinder on a sensitive balance to 5 mg. before the start and after the termination of a period. The loss in weight gave the amount necessary to supply the subject's needs and to bring the spirometer at the end back to the exact level which it had at the start. This amount was then corrected in the usual way[8] for any variation in temperature, barometric pressure and change in the composition of the air as indicated by the residual analyses.

For the latter purpose, a measured amount of air (usually 6 liters) was diverted from the train of absorbers from a point just after the blower where the pressure is high, and passed through three weighed U-tubes containing respectively sulphuric acid, soda lime and sulphuric acid, after which it passed through the meter, drying tower and back to the system, reentering at a point beyond the absorbers where the pressure is low. The gain in weight of the first tube gives the amount of water and the gain in weight of the second and third together gives the amount of carbon dioxid in the sample.

Heat values were all calculated from the corrected oxygen absorption, by multiplying by the calorific equivalent of oxygen for the respiratory quotient of the given period. The carbon dioxid absorbers were weighed to the same accuracy as the oxygen cylinder. Since the protein metabolism of the new-born infant is so small, no attempt was made to collect the urine, and the respiratory quotient obtained was considered as a nonprotein quotient. The well known table of Zuntz and Schumberg[14] was used for the calorific values of oxygen.

COMMENT ON GENERAL RESULTS

In this study of the respiratory metabolism of fifty children, 234 observations were made, but of this number only ninety-eight may be taken as basal periods to be used in determining basal metabolism. All the infants were under 2 weeks of age, and all but ten of the total number were under 1 week of age, at least when the series of observations was begun. In Cases 37 and 50 an observation was made when the infants were aged 6 and 11 hours respectively, but in all other cases they were at least 12 hours old. All were normal infants, for the most part children of parents in good financial circumstances.

Table 2 gives the data obtained for the fifty infants and includes birth weight, date of observation and age; length of period; total heat and heat per kilogram of body weight and heat per square meters of body surface calculated from the Lissauer formula ($10.3 \sqrt[3]{W^2}$) all per hour. The body temperature, pulse rate, which is an average of the rate taken every five minutes throughout the period, and relative activity are also given.

The first ten subjects may be regarded as preliminary to the entire series, so far as the effect of the quantity of food is concerned; for they were made before an accurate balance for recording the amount of food taken from the breast could be obtained. However, with one exception they were at least 5 days of age and always had been put to the breast directly before the experiment. In a few of the other babies

14. Zuntz, N., and Schumberg: Studien zu einer Physiologie des Märches, Berlin, 1901, p. 361.

TABLE 2.—*Gross Results of All Periods Used* *

Case	Sex	Weight, Kg.	Date	Days of Age	Feeding	Period	Length in Min.	Respiratory Quotient	Total Heat per Hour, Calories	Calories per Kg. per Hour	Calories per Sq. Meter (Lissauer) per Hour	Body Temperature, F.	Pulse per Min.	Activity
1	♀	3.99	1/17/21	12	Breast milk, amount not recorded	2	45	0.84	9.20	2.29	35.11	98.4	135	B
2	♀	2.78	1/20/21	6	Breast milk, amount not recorded	1	45	1.01	4.57	1.64	22.50	98.6	120	B
						2	45	0.73	5.52	2.06	28.17	....	120	B
3†	♂	2.95	1/25/21	5	Breast milk, amount not recorded	1	45	0.73	9.35	2.39	36.67	98.6	123	C
		2.95	1/27/21	7	Breast milk, amount not recorded	1	60	0.77	9.27	3.12	44.29	98.6	130	C
		3.04	1/29/21	9	Breast milk, amount not recorded	1	60	0.78	7.88	2.63	36.81	98.8	147	B
						2	60	0.80	8.93	2.98	41.85	98.8	146	C
4†	♂	3.12	1/22/21	2	Breast milk, amount not recorded	1	45	0.80	6.65	2.13	30.24	98.6	142	B
						2	45	0.68	6.62	2.12	30.10	....	135	B
		3.23	1/25/21	5	Breast milk, amount not recorded	1	46	0.72	7.34	2.29	32.76	98.0	125	B
		3.23	1/27/21	7	Breast milk, amount not recorded	1	61	0.80	9.59	3.00	42.83	98.0	124	C
		3.26	1/29/21	9	Breast milk, amount not recorded	1	60	0.86	8.20	2.56	36.61	98.6	126	B
						2	61	0.83	8.26	2.58	36.87	....	123	B
5	♀	3.01	2/ 1/21	8	Breast milk, amount not recorded	1	60	0.71	6.77	2.26	31.66	98.6	142	B
		3.13	2/ 3/21	10	Breast milk, amount not recorded	1	46	0.78	8.15	2.55	36.40	98.6	126	B
6	♂	3.86	2/21/21	10	Breast milk, amount not recorded	1	55	0.79	6.92	1.82	27.56	99.2	118	B
						2	55	0.79	6.76	1.78	27.50	....	114	SR
7	♀	3.14	3/ 7/21	8	Breast milk, amount not recorded	1	45	0.80	8.56	2.76	39.11	98.6	119	C
						2	45	0.92	7.12	2.30	32.54	....	132	B
		3.09	3/10/21	11	Breast milk, amount not recorded	1	47	0.93	6.21	2.00	28.35	98.6	128	B
						2	45	0.86	6.68	2.14	30.26	....	128	B
8	♂	2.80	3/17/21	5	Breast milk, amount not recorded	1	60	0.79	8.59	2.96	41.11	98.6	137	C
						2	65	0.77	8.42	2.73	37.81	....	134	C
		2.95	3/19/21	7	Breast milk, amount not recorded	1	60	0.89	6.59	2.41	33.24	98.6	126	C
						2	47	0.80	7.72	2.63	36.44	....	125	C
		3.06	3/21/21	9	Breast milk, amount not recorded	1	60	0.78	6.80	2.07	29.28	98.6	122	R
						2	50	0.76	6.39	2.06	29.21	....	111	C
9	♀	3.23	3/31/21	5	Breast milk, amount not recorded	1	45	0.87	7.72	2.41	34.52	98.0	135	R
						2	45	0.98	9.74	3.04	43.55	....	144	C
		3.29	4/ 2/21	7	Breast milk, amount not recorded	1	47	1.02	7.16	2.17	31.48	98.6	140	SR
						2	53	1.11	7.33	2.22	32.02	....	138	C
		3.35	4/ 4/21	9	Breast milk, amount not recorded	1	46	1.00	9.45	2.87	41.40	98.6	145	C
						2	44	0.84	9.98	3.02	43.70	....	140	R
10	♂	3.60	4/ 7/21	7	Breast milk, amount not recorded	1	48	1.02	7.18	2.16	30.30	98.6	124	C
						2	45	0.88	11.49	3.19	47.61	....	143	C
		3.69	4/ 9/21	9	Breast milk, amount not recorded	1	47	0.85	7.93	2.20	32.90	98.8	122	C
						2	49	0.81	10.98	3.04	45.70	....	126	C
11	♂	3.29	4/14/21	1	No feeding.....	1	60	0.78	7.15	2.23	31.97	98.6	115	B
						2	60	0.76	6.87	2.15	30.71	....	110	B
		3.12	4/15/21	2	56 gm. breast milk.....	1	50	0.72	7.62	2.46	34.81	98.6	116	C
						2	50	0.73	7.96	2.60	36.82	....	118	C
		2.90	4/16/21	3	56 gm. breast milk.....	1	50	0.76	8.68	2.99	41.47	98.6	119	C

* In the tables B = basal; C = cried; R = restless; SR = slightly restless; F = fretted; ♀ indicates female, ♂ male.
† Twins.
‡ Cesarean baby.

		3.12	4/18/21	5	28 gm. breast milk	1	50	0.73	7.24	2.36	33.27	98.6	112	B
						2	50	0.77	5.76	1.86	26.26	....	110	B
		3.23	4/21/21	8	84 gm. breast milk	1	50	0.67	10.54	3.22	46.46	98.6	122	C
						2	62	0.90	10.00	3.06	44.08	....	135	C
12‡	♂	3.40	4/25/21	8	No feeding	1	50	0.74	7.68	2.25	32.82	98.6	118	B
						2	50	0.82	9.27	2.47	36.12	....	123	C
		3.51	4/28/21	11	28 gm. breast milk	1	61	0.79	6.19	1.85	26.90	98.6	117	R
						2	45	0.72	6.91	2.07	30.07	....	114	B
13	♀	2.33	4/30/21	5	56 gm. breast milk	1	54	1.04	4.41	2.03	25.53	98.3	123	B
						2	45	0.72	5.13	2.36	29.71	....	120	B
		2.28	5/ 2/21	7	55 gm. breast milk	1	45	0.84	5.68	2.54	32.24	97.0§	143	B
						2	45	0.84	5.62	2.53	32.14	....	141	B
14	♀	3.16	5/ 5/21	3	No feeding	1	60	0.73	5.86	1.87	26.53	97.4	89	B
			5/ 7/21	5	50 gm. breast milk	1	50	0.72	6.66	2.10	29.92	96.6	98	R
						2	62	0.87	8.10	2.55	36.45	....	97	C
		3.27	5/ 9/21	7	27 gm. breast milk	1	90	0.89	6.19	1.93	27.84	96.0	94	C
15	♂	3.18	7/13/21 a.m.	6	117 gm. breast milk	1	60	0.71	8.38	2.63	37.50	98.1	106	C
		3.20	7/13/21 p.m.	6	50 gm. breast milk	1	60	0.85	6.74	2.11	30.21	98.8	115	R
16	♂	3.51	7/18/21 a.m.	3	5 gm. breast milk	1	60	0.73	9.44	2.69	39.81	100.0	108	C
			7/18/21 p.m.	3	24 gm. breast milk	1	65	0.77	7.44	2.12	31.40	100.4	106	C
						2	60	0.79	6.12	1.74	25.83	....	103	B
		3.54	7/19/21	4	48 gm. 5% lactose	1	66	0.80	8.15	2.33	34.38	99.4	110	C
						2	60	0.80	6.69	1.91	28.24	....	104	B
		3.53	7/20/21 a.m.	5	No record of feeding	1	45	0.89	7.38	2.09	31.01	98.6	118	C
			7/20/21 p.m.	5	30 gm. breast milk and 7 gm. 10% lactose	2	60	0.80	6.03	1.77	25.33	99.0	104	B
17	♀	3.87	7/25/21	2	7 gm. breast milk	1	50	0.71	7.38	1.89	28.89	99.2	109	B
						2	50	0.77	8.11	2.08	31.74	....	116	C
		3.92	7/26/21	3	45 gm. breast milk	1	50	0.73	8.04	2.05	31.42	99.0	106	C
		4.05	7/30/21 a.m.	7	28 gm. breast milk	1	50	0.68	6.71	1.66	25.62	98.8	104	B
			7/30/21 p.m.	8	28 gm. breast milk	1	50	0.68	6.89	1.70	26.29	98.8	107	B
						2	51	0.70	6.55	1.62	25.01	....	103	B
		3.93	8/ 3/21 a.m.	10	15 gm. breast milk	1	59	0.77	8.05	1.97	30.32	98.6	106	C
			8/ 3/21 p.m.	10	25 gm. breast milk	1	60	0.73	7.12	1.81	27.76	98.6	107	R
						2	60	0.75	7.04	1.81	27.70	....	107	C
18	♂	4.66	8/ 1/21 a.m.	10	74 gm. breast milk	1	78	0.80	13.16	2.83	45.84	98.2	132	C
						2	58	0.89	14.60	3.14	50.85	....	144	C
			8/ 1/21 p.m.	10	74 gm. breast milk	1	60	1.12	9.41	1.94	31.54	98.6	105	R
						2	60	0.95	8.07	1.72	27.91	....	112	C
		4.73	8/ 2/21 a.m.	11	No food	1	45	0.79	13.27	2.80	45.76	98.3	117	C
			8/ 2/21 p.m.	11	93 gm. breast milk	1	90	0.87	6.88	1.43	23.40	98.3	123	C
						2	60	0.89	8.58	1.78	29.17	....	112	C
19	♂	3.42	8/ 4/21 a.m.	7	Breast milk, amount not recorded	1	44	0.81	7.76	2.25	32.94	98.8	109	C
						2	45	0.78	6.35	1.90	27.76	....	93	C
			8/ 4/21 p.m.	7	76 gm. formula ⅓ milk dextri maltose	1	60	0.85	5.66	1.66	24.22	98.8	101	B
						2	66	0.85	5.82	1.66	24.29	....	92	B
		3.42	8/ 5/21 a.m.	8	51 gm. breast milk	1	60	0.74	6.56	1.87	27.40	98.8	92	B
						2	60	0.80	5.84	1.67	24.42	....	99	B
			8/ 5/21 p.m.	8	51 gm. formula	1	60	0.86	6.09	1.80	26.38	98.8	103	B
						2	61	0.97	5.42	1.64	23.97	....	105	B

§ Inoculated for smallpox day before.

TABLE 2.—*Gross Results of All Periods Used*—(Continued)*

Case	Sex	Weight, Kg.	Date	Days of Age	Feeding	Period	Length in Min.	Respiratory Quotient	Total Heat per Hour, Calories	Calories per Kg. per Hour	Calories per Sq. Meter (Lissauer) per Hour	Body Temperature, F.	Pulse per Min.	Activity
20	♀	3.42	8/ 9/21 a.m.	3	No feeding	1	67	0.74	7.38	2.21	32.28	98.6	108	C
			8/ 9/21 p.m.	3	5 gm. breast milk and 13 gm. 10% lactose	1	60	0.71	7.87	2.35	34.37	98.6	95	C
						2	60	0.76	7.82	2.24	32.79	....	94	C
		3.43	8/10/21 a.m.	4	No feeding	1	60	0.74	10.42	3.11	45.49	98.6	135	C
						2	45	0.75	8.82	2.56	37.60	....	125	C
			8/10/21 p.m.	4	19 gm. breast milk and 20 gm. 10% lactose	1	63	0.72	6.55	1.91	27.97	96.8	98	B
						2	60	0.71	6.07	1.73	25.30	....	95	B
		3.42	8/11/21 a.m.	5	No feeding	1	60	0.78	6.98	2.31	33.82	99.1	122	C
			8/11/21 p.m.	5	44 gm. 10% lactose	1	60	0.72	6.86	2.10	30.69	....	118	C
						2	61	0.77	5.52	1.60	23.47	....	100	B
21†	♂	3.57	10/19/21	1	Breast fed	1	47	0.66	8.87	2.49	37.09	98.0	131	F
						2	43	0.74	8.67	2.43	36.39	....	117	F
		3.32	10/22/21	4	Breast fed	1	48	0.72	9.86	2.96	42.96	100.0	126	F
		3.65	10/27/21	9	Breast fed	1	40	0.89	7.69	2.21	32.90	99.0	128	B
		3.87	11/ 1/21	14	Breast fed	1	62	0.92	8.00	2.06	31.48	98.4	124	B
22†	♀	3.27	10/19/21	1	Breast fed	1	54	0.72	7.53	2.30	33.16	97.4	136	F
						2	39	0.78	7.72	2.36	34.04	....	144	C
			10/27/21	9	Breast fed	1	40	0.88	7.02	2.07	30.29	99.0	128	F
			11/ 1/21	14	Breast fed	1	32	1.02	9.44	2.79	40.89	98 0	130	C
		3.41				2	30	0.97	6.70	2.00	29.32	....	128	B
23	♂	3.04	11/ 3/21	10	35 gm. breast milk	1	45	0.92	9.32	3.07	43.12	99.4	132	C
						2	50	0.91	8.50	2.80	39.34	....	130	C
24	♂	3.55	12/15/21	1	Breast feeding followed by formula, amount not recorded	1	45	0.83	8.50	2.39	35.56	99.4	133	C
						2	44	0.87	7.67	2.29	34.09	....	127	C
		3.44	12/17/21	3	Breast feeding followed by formula, amount not recorded	1	45	0.79	7.50	2.18	32.02	98.6	161¶	B
						2	39	0.85	7.80	2.27	33.35	....	142	C
		3.53	12/20/21	6	Breast feeding followed by formula, amount not recorded	1	45	0.84	6.86	1.94	28.81	98.1	112	F
						2	45	0.77	6.39	1.81	26.84	....	106	B
		3.60	12/22/21	8	Breast feeding followed by formula, amount not recorded	1	45	0.77	10.25	2.85	42.38	98.6	138	C
						2	48	0.81	9.89	2.75	40.88	....	133	C
25	♀	2.85	1/10/22	8	Breast fed	1	44	1.07	5.81	2.14	29.51	98.6	122	C
						2	45	0.92	6.69	2.34	32.32	....	126	C
26	♀	3.15	1/18/22	5	Breast fed	1	61	0.86	6.45	2.05	29.08	97.4	103	B
						2	41	0.80	6.28	1.99	28.28	....	100	B
27	♀	3.44	1/24/22	3	Breast fed	1	45	0.95	5.69	1.71	24.96	97.6	109	B
						2	45	1.02	5.16	1.50	21.95	....	112	B
		3.46	1/26/22	5	Breast fed	1	52	1.01	7.14	2.05	30.26	97.4	119	B
						2	32	1.16	3.89	1.13	16.52	....	122	B
28‡	♀	3.58	2/24/22	11	Breast fed	1	50	0.79	7.39	2.07	30.68	97.0	113	B
						2	40	0.77	8.33	2.33	34.55	....	106	B
		3.60	2/27/22	14	Breast fed	1	45	0.95	9.34	2.60	38.75	97.8	116	C
						2	45	0.90	7.82	2.13	31.64	....	115	B
		3.62	2/28/22	15	Breast fed	1	50	0.78	7.72	2.14	32.62	98.0	115	B
29	♂	2.85	5/ 8/22	5	Breast fed	1	60	0.73	6.16	2.32	31.80	97.8	119	B
						2	60	0.68	5.32	1.93	26.46	....	108	B
		2.88	5/10/22	7	23 gm. formula	1	49	0.89	6.22	1.76	24.35	98.4	102	B
						2	55	0.78	6.89	1.91	26.39	....	105	B

¶ Cried all morning.

30	♂	3.74	6/28/22 a.m.	3	No feeding	1	59	0.75	6.13	1.65	24.79	98.6	110	R
						2	60	0.69	6.45	1.79	26.92	....	114	C
		3.77	6/28/22 p.m.	3	38 gm. breast milk	1	50	0.72	8.42	2.19	33.07	98.2	112	C
						2	38	0.89	9.02	2.49	37.49	....	111	C
		3.83	6/29/22 a.m.	4	38 gm. breast milk	1	46	0.78	9.68	2.53	38.44	98.0	128	C
						2	50	0.68	9.24	2.42	36.68	97.4	121	C
			6/29/22 p.m.	4	10% lactose; vomited, retained at least 14 gm.	1	61	0.73	10.20	2.67	40.50	97.4	132	C
31	♂	3.25	6/30/22	2	10% lactose	1	49	0.72	7.16	2.19	31.55	98.3	138	SR
		3.27	7/ 1/22	3	32 gm. breast milk	1	44	0.75	7.12	2.16	31.21	98.0	118	B
						2	45	0.75	7.31	2.22	32.07	....	120	B
32	♂	3.83	7/ 6/22	4	31 gm. breast milk	1	53	0.71	6.61	1.80	27.19	97.6	120	B
		3.88	7/ 7/22	5	67 gm. breast milk	1	44	0.78	7.44	1.88	28.93	98.0	117	B
						2	44	0.73	7.77	2.11	32.37	....	124	C
33	♂	3.63	7/ 8/22	1	28 gm. 10% lactose	1	48	0.89	9.14	2.05	30.69	97.4	112	C
						2	46	0.80	6.37	1.72	25.79	....	119	B
		3.44	7/10/22	3	27 gm. 10% lactose	2	44	0.76	6.51	2.07	30.38	98.6	122	F
		3.40	7/11/22	4	51 gm. breast milk	1	49	0.74	6.98	2.03	29.72	98.4	117	B
34	♂	3.84	7/12/22 a.m.	1	No feeding	1	38	0.87	7.43	1.97	29.29	98.6	130	C
						2	38	0.76	8.04	2.37	35.26	....	135	R
		3.52	7/12/22 p.m.	1	No feeding	1	44	0.80	7.91	2.02	29.84	98.3	130	C
						2	46	0.76	6.92	2.10	30.99	....	135	R
		3.32	7/13/22	2	7 gm. breast milk and 7 gm. 10% lactose	1	49	0.82	6.95	1.89	27.47	98.0	122	C
						2	50	0.73	6.45	1.94	28.05	....	117	R
		3.29	7/14/22	3	8 gm. breast milk and 13 gm.10% lactose	2	39	0.69	6.24	1.94	28.02	98.0	122	..
35	♀	2.72	7/15/22	3	No feeding	1	53	0.66	6.87	2.51	34.01	97.2	126	C
			7/17/22	4	12 gm. breast milk and 14 gm. 10% lactose	1	50	0.67	6.29	2.28	30.90	98.6	132	B
						2	46	0.76	6.32	2.29	31.12	....	129	C
		2.76	7/18/22	6	26 gm. 10% lactose	1	40	0.72	5.66	2.03	27.88	97.8	120	B
						2	42	0.66	5.45	1.96	26.84	....	120	B
						3	52	0.87	7.54	2.97	40.77	....	131	C
		2.78	7/19/22 a.m.	7	35 gm. breast milk	1	45	0.75	5.88	2.06	28.40	97.0	130	R
						2	50	0.82	8.06	3.23	44.47	....	129	C
		2.85	7/19/22 p.m.	7	37 gm. 10% dextrose	1	51	0.71	6.08	2.17	29.37	97.0	135	B
						2	50	0.73	5.86	2.06	28.29	....	123	B
36	♀	2.85	7/20/22 a.m.	2	25 gm. 10% lactose	1	46	0.82	7.60	1.92	29.21	98.0	131	R
						2	52	0.74	7.63	1.97	30.02	....	127	R
		3.87	7/20/22 p.m.	2	42 gm. 10% dextrose	1	46	0.96	6.39	1.65	25.16	98.0	123	B
		3.79	7/21/22 a.m.	3	29 gm. 10% lactose	1	45	0.75	7.20	1.90	28.68	99.8	127	F
						2	43	0.73	6.72	1.77	26.79	98.0	125	R
			7/21/22 p.m.	3	48 gm. 10% dextrose	1	45	0.70	6.97	1.84	27.77	98.0	132	F
						2	44	0.73	7.32	1.95	29.17	....	133	F
37	♀	3.49	7/25/22	6 hrs.	No feeding	1	45	0.76	8.51	2.44	36.04	97.8	126	C
		3.37	7/26/22 a.m.	2	15 gm. 10% lactose	1	43	0.81	7.78	2.27	33.00	97.8	126	R
						2	44	0.72	7.98	2.30	33.49	....	121	R
			7/26/22 p.m.	2	27 gm. 10% dextrose	1	48	0.80	8.20	2.38	34.60	97.8	124	F
						2	52	0.84	6.90	2.05	29.88	....	117	B
		3.38	7/27/22 a.m.	3	34 gm. breast milk	1	58	0.77	7.21	2.13	31.06	98.0	126	R
						2	52	0.73	6.95	2.14	31.17	....	128	R
			7/27/22 p.m.	3	14 gm. breast milk and 44 gm. 10% dextrose	1	44	0.85	6.77	1.94	28.24	97.8	126	R
						2	45	0.77	7.06	2.12	30.86	....	127	R

TABLE 2.—*Gross Results of All Periods Used*—(Continued)*

Case	Sex	Weight, Kg.	Date	Days of Age	Feeding	Period	Length in Min.	Respiratory Quotient	Total Heat per Hour, Calories	Calories per Kg. per Hour	Calories per Sq. Meter (Lissauer) per Hour	Body Temperature, F.	Pulse per Min.	Activity
38	♀	3.59	7/28/22 a.m.	2	No feeding	1	58	0.75	7.45	2.08	30.93	97.0	123	C
			7/28/22 p.m.	2	44 gm. 10% dextrose	1	58	0.71	7.30	2.03	31.71	97.0	127	B
39	♀	3.65	8/ 1/22 a.m.	2	No feeding	1	48	0.67	8.00	2.19	32.78	98.6	116	C
						2	48	0.72	7.81	2.14	32.03	....	122	F
			8/ 1/22 p.m.	2	15 gm. 10% lactose	1	47	0.77	8.98	2.46	36.83	98.6	132	C
						2	46	0.70	8.49	2.33	34.81	....	124	C
			8/ 2/22 a.m	3	34 gm. 10% dextrose	1	43	0.71	7.82	2.13	31.94	98.6	126	R
						2	43	0.80	9.22	2.62	39.42	....	130	C
			8/ 2/22 p.m.	3	30 gm. breast milk	1	42	0.68	6.89	1.88	28.11	98.6	126	R
40	♂	3.54	8/15/22 a.m.	1	No feeding	1	53	1.02#	7.49	2.12	31.48	98.0	133	C
		3.59	8/15/22 p.m.	1	23 gm. 10% lactose	1	36	0.82	6.30	1.71	25.41	98.0	135	B
						2	44	0.78	6.36	1.70	25.25	....	135	B
		3.47	8/16/22	2	27 gm. 10% dextrose	1	41	0.67	7.39	2.13	31.32	98.4	123	C
		3.39	8/17/22 a.m.	3	47 gm. 10% lactose	1	46	0.84	6.94	2.02	29.64	97.0	119	B
						2	44	0.65	6.81	1.98	29.10	....	121	B
		3.44	8/17/22 p.m.	3	46 gm. breast milk	1	45	0.70	8.31	2.34	34.42	98.0	121	B
						2	45	0.68	5.98	1.81	26.59	....	126	B
			8/18/22	4	32 gm. breast milk	1	46	1.00#	9.64	2.76	40.69	97.8	134	C
						2	41	0.66	7.23	2.08	30.69	....	126	B
41	♀	4.44	10/ 9/22 a.m.	2	No feeding	1	51	0.84	11.43	2.58	41.12	99.0	144	C
						2	53	0.70	10.76	2.43	38.71	....	115	R
			10/ 9/22 p.m.	2	41 gm. 10% lactose	2	40	0.82	9.39	2.16	34.50	98.4	105	B
42	♀	3.23	10/13/22 a.m.	3	Breast milk, amount not certain..	1	43	0.72	7.56	2.34	33.59	98.0	134	B
						2	45	0.82	5.98	1.84	26.36	....	121	B
			10/13/22 p.m.	3	36 gm. 10% lactose	1	51	0.80	6.74	2.13	30.58	98.4	124	B
						2	44	0.73	7.09	2.19	31.50	....	121	B
43	♀	3.71	10/30/22 a.m.	3	13 gm. breast milk	1	50	0.86	13.32	3.58	58.52	98.0	121	C
		3.73	10/30/22 p.m.	3	17 gm. breast milk and 37 gm. 10% lactose	1	35	0.78	6.37	1.71	26.99	98.0	109	B
						2	41	0.73	7.51	2.02	30.41	....	112	B
44	♂	3.27	11/ 1/22	1	No feeding	1	40	0.73	6.20	1.84	26.62	99.0	127	B
45	♂	3.48	11/ 8/22	1	No feeding	1	43	0.72	9.08	2.60	38.25	99.8	114	F
						2	44	0.78	8.61	2.40	36.49	....	117	B
		3.27	11/10/22	3	11 gm. breast milk	1	75	0.77	8.47	2.60	37.38	98.6	123	C
46	♂	2.92	11/11/22 a.m.	3	14 gm. breast milk	1	47	0.67	6.10	2.13	29.52	98.8	108	B
		2.98	11/11/22 p.m.	3	26 gm. 10% lactose	1	39	0.72	6.27	2.39	33.28	98.8	115	B
47	♀	3.10	11/17/22 a.m.	3	10 gm. breast milk	1	47	0.77	7.31	2.36	33.36	98.4	128	C
						2	41	0.70	6.07	1.96	27.71	....	118	B
			11/17/22 p.m.	3	27 gm. 10% lactose	1	42	0.70	6.40	2.17	30.73	98.4	114	B
						2	45	0.74	6.28	2.03	28.69	....	116	B
48	♂	3.45	11/20/22	14 hrs.	No feeding	1	78	0.78	8.87	2.57	37.73	98.0	116	C
49	♀	3.66	3/10/23	2	No feeding	1	41	0.72	7.39	2.02	30.17	98.4	106	C
						2	49	0.85	7.66	2.09	31.27	....	104	C
50	♂	4.15	3/12/23	11 hrs.	No feeding	1	42	0.83	7.95	1.92	29.90	99.0	102	B
						2	45	0.73	7.61	1.84	28.64	....	101	B
		3.88	3/14/23	3	30 gm. 10% lactose	1	39	0.70	8.34	2.15	31.84	....	108	B
						2	39	0.72	7.91	2.04	31.13	....	113	B

Case of closing first period too soon after crying.

there is no record of the amount of the feeding, because the nurse put the infant to breast without previously weighing it and in some instances because the child regurgitated an unknown amount of food.

BASAL METABOLISM

In obtaining the average heat production of the infants studied, two values were found, in the first of which were averaged the heat productions for all basal periods, that is, of all periods in which the child was entirely quiet throughout. In many of the cases studied there were several basal periods for each child, all of which were included. The second value is that of minimum heat production, in which is averaged only the lowest heat production for each child.

Total heat production which varies, in general, with the weight and age of the child, was found to be 6.67 calories per hour when all the basal periods were averaged. Heat production when measured per kilogram of body weight varied from 1.84 calories per hour to 2.07 calories for basal periods, with an average of 2.00 calories per hour. The minimal heat per kilogram per hour was 1.86 calories. Heat per square meter of body surface (Lissauer formula) for basal periods was found to be 29.16 calories per hour, and 27.42 calories per hour for the minimal average.

THE RESPIRATORY QUOTIENT

Ordinarily, the activity of the infant is without effect on the respiratory quotient unless perchance a period was ended too soon after the child had had a hard crying spell, in which case there would be an increased output of carbon dioxid sufficient to lower the carbon dioxid of the blood, followed by a decrease below normal with accumulation in the blood in the next period when the child became quiet (compare Case 40). However, if a little time is allowed, conditions will become balanced again and the respiratory quotient will be unaffected. For the study of individual respiratory quotients this procedure would, of necessity, have to be followed and usually was in our experiments, but for the purpose of an average, either method serves equally well, and the averages shown in Table 3 of all the periods are only slightly different from the averages of only basal periods.

TABLE 3.—*Effect of Age on Respiratory Quotient*

	Day of Age										
	1	2	3	4	5	6	7	8	9	10	11
Number of observations	24	28	53	17	24	9	20	17	12	12	9
Respiratory quotient	0.79	0.76	0.75	0.75	0.81	0.80	0.82	0.81	0.85	0.85	0.82

Case of closing first period too soon after crying.

The respiratory quotient is dependent on the time allowed to elapse between the time of feeding and the respiratory study and likewise on the amount and character of the food. This first condition was kept nearly constant because the child, as a rule, was fed directly before being put in the chamber and the preliminary period was always in the neighborhood of one-half hour in length. The feedings themselves were by no means constant either in kind or amount, and rarely were constant in either respect even for the same child (see Table 2). The purpose of these variations was to see what influence artificial feedings of several sorts would have on the respiratory quotient and the dynamic action.

The average respiratory quotient for all the infants studied on each of the first eight days is given in Table 3. The "days of age" as used in this and all the other tables denotes the first, second and so forth, twenty-four hour period from birth within which the observation was made. This usage does not accord with the frequent custom of nurses in disregarding the last hours of the day of birth. Physiologically, it makes a difference whether "first day" actually means first twenty-four hours from the birth hour. Beyond five or six days, of course, it is of little consequence how the time is reckoned.

The respiratory quotient within the first day in periods uninfluenced by crying, varies from 0.66 to 0.83. The tendency, however, is for the quotient to be distinctly higher on this than on the next three days and the average of twenty-four observations is 0.79. Excluding all periods when the baby was fed just before the respiratory study, the average respiratory quotient is 0.77 for the first day and 0.74 for the second day; and ruling out all periods when the baby was artificially fed on the first day, the respiratory quotient for this day is 0.78. It is plain that whatever may be the actual amount of glycogen stored in the infant's body at birth, it cannot play any great part in the combustion for many hours thereafter. The subjects in the present series were not selected with special reference to the study of the glycogen storage, and as a matter of fact only two were placed in the respiration chamber before they were 12 hours of age. Hasselbach [15] and Bailey and Murlin [13] reported some high respiratory quotients in the early hours after birth, and their possible significance has been fully discussed in Abt's Pediatrics.[16]

The average quotient within the second twenty-four hours is 0.76, and this is not influenced by the artificial feedings which were made; for when the quotients immediately following such feedings are crossed off the list the average remains the same. Breast milk feedings seem to

15. Hasselbach, K. A.: Respirationsforsog paa hyfodte Born, Bibliotek for Læger, Copenhagen, 1904, translated by Miss A. Johnson, in Benedict and Talbot.[17]

16. Murlin, J. R.: Abt's Pediatrics, Philadelphia, **1**:600, 1923.

influence the quotient more on this day and on subsequent days than artificial feedings. On the third day the average of all periods is 0.75, on the fourth the same value holds, but on the fifth it rises suddenly to 0.81. Since it is only on the fifth day that the supply of breast milk usually becomes adequate [13] we may look on this sudden elevation of the quotient as a sign that the glycogen stores of the body are becoming filled up once more. The average value 0.85, which denotes really good nutrition is not reached until the ninth day by which time most of the babies had returned to birth weight. Comparing the fluctuations from day to day of the respiratory quotient in this series with those in Benedict and Talbot's [17] series, one gets the impression that the Rochester babies were in a better state of nutrition than the Boston babies, through the first five days at least.

TABLE 4.—*Effect of Age on Basal Heat Production*

	Day of Age							
	1	2	3	4	5	6	7	8
Number of observations.....	8	7	23	7	14	5	9	9
Total heat, calories per hour.....	6.85	7.17	6.69	6.63	6.01	5.51	6.06	6.31
Heat per square meter per hour..	28.04	30.06	29.33	28.58	27.69	26.44	27.43	27.88
Heat per kilogram per hour.....	1.88	1.99	2.01	1.96	1.97	1.89	1.98	1.90

INFLUENCE OF AGE ON BASAL METABOLISM

In Table 4 the basal metabolism expressed in three ways are brought together by days of age; namely, as total heat per hour, heat per square meter (Lissauer) per hour, and heat per kilogram per hour. The averages for basal and minimal for the entire series have already been stated. Only the first eight days are shown, for the reason that the number of successful basal periods beyond this for the individual days was too small to be of significance. Both on the basis of total heat and of heat per unit of surface the highest metabolism falls on the second day. From this point it declines steadily and nearly uniformly, to the sixth day, when it is lowest. The number of basal observations for this day, however, is only five, and on the seventh and eighth day the metabolism has returned to the level of the fifth day. The metabolism suddenly increases the ninth day, the average for fourteen basal periods on the ninth, tenth and eleventh days being 7.54 calories per hour or 31.44 calories per square meter of surface per hour. A sudden rise at the beginning of the second week has been interpreted by Marine [18] as possibly related to the normal destruction of the reticular and fascicular layers of the suprarenal cortex.

17. Benedict, F. G., and Talbot, F. B.: Pub. 233, Carnegie Inst., Washington, 1915.

18. Marine, D.; Lowe, B. H., and Cipra, A.: J. Metabolic Res. **2**:329 (Sept.) 1922.

This course of the metabolism through the first week suggests at first sight a relationship to the postnatal loss of weight. Unfortunately, we cannot give an average weight curve for the subjects on which the basal metabolism was obtained nor for the entire series of new-born studies. Through the courtesy of Dr. W. W. Winans, however, we are able to cite the course of the curve in 1,000 consecutive breast-fed, normal infants from the same service, whose birth weight was at least 6 pounds (2.7 kg.). The average weight at birth was 7.50 pounds (3.2 kg.) for girls and 7.60 pounds (3.3 kg.) for boys; on the fourth day it was 7.0 pounds (3.2 kg.)—the lowest—for both sexes, but the return to birth weight did not occur until the fourteenth day for those babies which remained that length of time in the hospital. It is probable that the average weight curve of the babies in the present series was somewhat better than this. At all events the loss in weight begins at once and almost certainly terminates before the lowest point in the metabolism is reached.

This table of values differs somewhat from that of Benedict and Talbot.[17] They noted a lower metabolism the first day, 24.66 calories per square meter (Lissauer) as compared with 28.04 calories in this series. The difference may be accounted for by the fact that the majority of their first day infants were studied before they were 12 hours old, while the majority of ours, five out of six, were studied after the age of 12 hours. From the second to the seventh days Benedict and Talbot found an "essentially constant" heat production, at about 27.5 to 28.5 calories per square meter per hour. On the eighth day it rose to 29.25 calories. The average for the entire eight days of their study was 27.1 calories per square meter, while the average for the basal periods only, for the eight days shown in Table 4 is 28.00 calories even.

BODY WEIGHT VERSUS SURFACE AREA AS A MEASURE OF BASAL METABOLISM

In a continuous series of observations on subjects differing but little in weight, there is little to choose between these two units of measurement.[16] Nevertheless, we have taken the trouble to determine the standard deviations and coefficients of variability of the basal heat production in this series of infants on both bases of measurement.

	Standard Deviation $\sigma_x = \sqrt{\Sigma[x - x']^2/N}$	Coefficient of Variability $P_x = \frac{\sigma \times 100}{x'}$
Basal heat per square meter (Lissauer)	3.488 ± 0.158	11.95 per cent.
Basal heat per kilogram of body weight	0.259 ± 0.0117	13.00 per cent.

The standard deviation, being the square root of the sum of the squares of the deviations from the mean divided by the number of observations, signifies nothing except when compared with that of another like series of measurements, but when the standard deviation from the mean value is calculated as a percentage of the mean it can be compared as an expression of the degree of variability (coefficient of variability) with that of any other series of variables. This coefficient is seen to be slightly lower for the heats as measured by surface area than when measured by body weight. In other words, heat is slightly less variable, when measured by the unit of surface, as usual.

The question, which formula best expresses the body surface of infants has been fully discussed elsewhere.[16] In correlation of heat production with body surface, it has been shown to be of little moment whether one or the other of several well known formulas is used in a consideration of a series of subjects. In individual cases differing widely from the average type it would be of great importance. The recent modification of Lissauer's formula made by Benedict and Talbot [19] because it could thereby be made to agree with results obtained by the DuBois linear formula, offers no material improvement because the several constants employed in this formula have not been established for the infant. It is scarcely possible that they can be the same for new-born infants as for adults. A modification of the DuBois and DuBois height-weight formula also has been proposed by Faber and Melcher.[20] The authors state that they have measured the surface areas of 100 new-born babies "by the Sawyer, Stone and DuBois method and compared (them) with the results obtained by the height-weight formula of DuBois and DuBois." We understand this refers to the linear measurements of Sawyer, Stone and DuBois and not the actual measurement of surface by the paper mould method. The same criticism, of course, applies to this modification, and the additional criticism of the difficulty of getting a satisfactory measurement of height (length) of the new-born. How much should the naturally curved legs of the new-born be straightened by pressure in order to secure the exact length? We have observed that it is possible by varying the pressure on the legs within the tolerance of the child for discomfort to vary the total length as much as from 1 to 2 cm. which makes a difference of 2.5 to 5.0 per cent. This added to errors in the constants of the linear formula often would make a total error which would be intolerable. For these reasons

19. Benedict, F. G., and Talbot, F. B.: Pub. 302, Carnegie Inst., Washington, 1921.

20. Faber, H. K., and Melcher, M. S.: Proc. Soc. Exper. Biol. & Med. **19**:53, 1921.

we have resolved to abide by the original Lissauer formula with its admitted inadequacy, until some courageous person undertakes the actual measurements of the surfaces of the cadavers of new-born infants in a good state of nutrition at death, by the paper mould method and by this means establish the correct constants for the linear formula for such subjects.

In a small number of the present series fairly satisfactory (?) measurements of total length were obtained and the surface calculated by the modified formula of Faber and Melcher. It was found to agree with the original Lissauer formula to within an average difference of 0.83 per cent.

PULSE AS A MEASURE OF METABOLISM

Because the pulse rate increases during activity and especially when the child cries, and because the metabolism is also increased by activity, it has been thought by some workers that the pulse rate might be taken as a measure of the heat production. Benedict and Talbot [7] state that the "pulse rate was a better index of activity than the kymographic record" and conclude that pulse rate is a good index likewise of metabolism. In a later study of 105 infants [17] they still maintain this belief, but a statistical study of their figures made by Murlin [16] reveals the fact that there is very little correlation between the two.

The coefficient of correlation is determined by the formula $r_{hp} = \frac{\Sigma [(h-h')(p-p')]/N}{\sigma_h \quad \sigma_p}$ where h-h′ is the deviation of each heat (expressed as total heat per hour) from the mean heat production; p-p′ the deviation of each average pulse rate for each period from the mean pulse rate, and σ_h and σ_p are the standard deviations of the heat and the pulse obtained by the formula given in the preceding section.

For the Benedict and Talbot series of ninety-four new-born infants, the coefficient of correlation turned out to be 0.276 with a probable error of $\pm$ 0.0643 for their basal periods. For basal periods in our series the coefficient was 0.178 with a possible error of $\pm$ 0.0673 but for all the periods, crying as well as quiet, it was 0.374 $\pm$ 0.0372.

Since a perfect correlation would be represented by unity, there is a slightly better correlation during activity than there is during quiet periods, but such figures as 0.276, 0.178 and even 0.374 surely do not show a very high degree of correlation and we must consider pulse as a very poor measure of metabolism. Hard crying not infrequently raises the metabolism 100 per cent. above the basal, while the pulse as a rule increases only 15 or 20 per cent. (See for example, Cases 18 and 43, Tables 2 and 6). Benedict and Talbot's Table 17 shows many such disproportions between increase of pulse and increase of metabolism.

THE INFLUENCE OF MUSCULAR ACTIVITY

The muscular activity of infants, particularly new-born infants whose movements are largely of a reflex character, is of interest in connection with the energy metabolism from several points of view. (1) How much can the metabolism be raised by crying? (2) Is there any uniformity in the energy expenditure of crying? (3) Are the muscles as efficient in performing mechanical work as the muscles of the adult? (4) Is one kind of food more efficient than another in supporting the muscular effort of crying?

The several published observations on the first of these questions have been reviewed recently elsewhere.[16] The present series has afforded opportunity to make rather more definite measurements of the time occupied in crying than have been attempted before and some interesting results are brought together in Tables 5 and 6. The crying time was recorded by the nurse on paper ruled in minutes, and this record evalu-

TABLE 5.—*Effect of Muscular Effort on Metabolism (Successive Periods in Same Observation)*

Case	Weight, Kg.	Day of Age	Respiratory Quotient	Heat per Sq. Meter Hourly	Heat per Kg. Hourly	Activity: Minutes Cried	Activity: Length of Period, Min.	Per Cent. Increase: Activity	Per Cent. Increase: Metabolism
3	3.04	9	0.78	36.81	2.63	B			
			0.89	41.85	2.98	C 20	66	33	13
7	3.14	8	0.80	39.11	2.76	C 8	45	18	20
			0.92	32.54	2.30	B			
9	3.23	5	0.87	34.52	2.41	R			
			0.98	43.55	3.04	C 20	45	44	26
12	3.40	8	0.74	32.82	2.25	B			
			0.82	36.12	2.47	C 10	50	20	10
14	3.16	4	0.72	29.92	2.10	R 7	50		
			0.87	36.45	2.55	C 25	62	26	21
16	3.51	3	0.77	31.40	2.12	C 16	65	24	21
			0.79	25.83	1.74	B			
	3.54	4	0.71	34.38	2.33	C 12	66	18	21
			0.80	28.24	1.91	B			
17	3.87	2	0.71	28.89	1.89	B			
			0.77	31.74	2.08	C 12	50	24	10
20	3.43	4	0.72	30.69	2.10	C 7	60	12	31
			0.77	23.47	1.60	B			
22	3.41	14	1.02	40.89	2.79	C 12	32	37	30
			0.97	29.32	2.00	B			
28	3.60	14	0.95	38.74	2.60	C 8	45	17	22
			0.90	31.64	2.13	B			
32	3.88	5	0.78	28.93	1.88	B			
			0.73	32.37	2.11	C 7	44	16	12
33	3.63	1	0.89	30.69	2.05	C 11	48	23	19
			0.80	25.79	1.72	B			
35	2.76	6	0.72	26.88	2.03	B			
			0.87	40.77	2.97	C 28	52	54	51
	2.78	7	0.75	28.40	2.06	S. R.			
			0.82	44.47	3.23	C 31	50	60	56
39	3.65	3	0.71	31.92	2.13	S. R.			
			0.80	39.42	2.62	C 14	43	32	23
50	3.44	4	1.00	40.69	2.76	C 20	46	43	32
			0.66	30.69	2.08	B			
47	3.10	2	0.77	33.36	2.36	C 12	47	25	20
			0.70	27.71	1.96	B			
Average								29.2	24.5

TABLE 6.—*Effect of Muscular Effort*
(Increase of Maximum Over Minimum)

Case	Weight, Kg.	Day of Age	Feeding	Period	Respiratory Quotient	Heat per Sq. M. Hourly	Heat per Kg. Hourly	Activity: Minutes of Activity	Activity: Length of Period Min.	Per Cent. Increase: Activity	Per Cent. Increase: Metabolism
10	3.60	7	Amt. not recorded...	1	1.02	30.30	2.16	C 5	48		
				2	0.83	47.61	3.19	C 30	45	56	57
14	3.16	2	None.....	1	0.73	26.53	1.87	B			
		4	50 gm. B. M.	2	0.87	36.45	2.55	C 25	62	40	37
15	3.18	6	117 gm. B. M.	1	0.71	37.59	2.63	C 7	60	11	24
			50 gm. B. M.	1	0.85	30.21	2.11	S. R.			
16	3.51	3	5 gm. B. M.	1	0.73	39.81	2.69	C 20	60	33	56
	3.53	5	7 gm. 10% lactose..	1	0.80	25.53	1.71	B			
17	3.87	2	7 gm. B. M.	2	0.77	31.74	2.08	C 12	50	24	26
	4.05	7	28 gm. B. M.	2	0.70	25.01	1.62	B			
18	4.66	10	74 gm. B. M.	1	0.80	50.85	3.14	C 40	58	62	117
	4.73	11	93 gm. B. M.	1	0.87	23.40	1.43	C 7	90		
19	3.42	7	Amt. not recorded...	1	0.81	32.94	2.25	C 17	44	38	36
		7	76 gm. B. M.	1	0.85	24.22	1.66	B			
20	3.43	3	No food.....	1	0.74	45.49	3.11	C 47	60	77	79
		3	19 gm. B. M., 20 gm. 10% lactose	2	0.71	25.30	1.73	C 1			
21	3.32	4	Breast fed, amount not recorded	1	0.72	42.96	2.96	C 24	48	50	37
	3.87	14	.....	1	0.92	31.48	2.06	B			
24	3.53	6	Breast followed by formula, amount not recorded	2	0.77	26.84	1.81	F 3	45		
				1	0.77	42.38	2.85	C 18	45	34	57
28	3.58	11	Breast fed, amount	1	0.79	30.68	2.07	B			
	3.60	14	not recorded	1	0.95	38.74	2.60	C 18	45	40	26
30	3.74	3	No food.....	1	0.75	24.79	1.65	R			
	3.83	4	Small amount 10% lactose	1	0.73	40.50	2.67	C 32	61	52	61
35	2.76	6	26 gm. 10% lactose...	2	0.75	26.84	1.95	S. R.			
	2.78	7	35 gm. B. M.	2	0.82	44.47	3.23	C 40	50	80	81
37	3.49	6 hr.	No feeding.....	1	0.76	36.04	2.44	C 16	45	35	22
	3.37	2	27 gm. 10% dextrose.	2	0.84	29.88	2.05	B			
39	3.65	3	34 gm. 10% dextrose.	2	0.80	39.42	2.62	C 19	43	44	39
		3	30 gm. B. M.	1	0.68	28.11	1.88	R			
40	3.54	1	No feeding.....	1	1.02	31.48	2.12	C 20	53	37	23
		1	23 gm. 10% lactose...	1	0.82	25.51	1.71	R 18			
	3.44	4	32 gm. B. M.	1	1.00	40.69	2.76	C 25	46	54	32
				2	0.66	30.69	2.08	B			
41	4.44	2	No feeding.....	1	0.84	41.12	2.58	C 14	51	27	19
		2	41 gm. 10% lactose...	1	0.82	34.50	2.26	B			
43	3.71	3	12 gm. B. M.	1	0.86	58.92	3.58	C 33	50	66	109
		3	17 gm. B. M., 37 gm. 10% lactose	1	0.78	26.99	1.71	B			
Average.....										45	49

ated by two of us independently, has been checked also against the graphic record. In Table 5 the comparison is between adjacent periods of the same observation, one of them being basal or nearly so and the other occupied for a portion of the time in frank crying. Mere whimpering or fretting has not been included in these comparisons. The influence of food in this table, while not uniform in different cases, is qualitatively the same in the two periods compared for each case. In a later section it will be shown that in the majority of cases the greater dynamic effect of food comes in the first period. In the table before us the crying

period in exactly half of the instances comes first. The effect of food therefore has been nullified quite by chance as much perhaps as it would be possible to do deliberately.

The observation periods being of unequal length, it is necessary to express the activity (crying) not in absolute units of time but as a percentage of the whole period. When this is done and the increase in metabolism is placed alongside, one is struck at once with the rather frequent occurrence of agreement between the two figures, and is prepared in spite of some wide variations, to find the average percentage of time occupied in crying balance pretty well the average percentage increase in metabolism.

Taken as a rough average, it may be said that just as much energy is required to support healthy crying as to support the baby at the basal level. Different crying periods for the same child (Cases 16 and 35) agree fairly well with each other and with the general rule. This is a rate of activity which can be sustained up to 60 per cent. of the time. Can it be sustained longer? It happened that no subject of the present series exhibited a crying activity of more than 60 per cent. adjacent to a true basal period. In Table 6, however, where maximal metabolism is compared with minimal, whether in adjacent periods or not, four infants are found which cried more than 60 per cent. of the observation time. Two of these exactly sustained the rate of increase noted in Table 5, and the other two exceeded this rate, one going to 109 per cent. increase in metabolism for 66 per cent. of the time occupied in crying, and the other, winning out with 117 per cent. for 63 per cent. of the time. In the case of only one of the four contestants, and that not the winner, could the dynamic action of food have contributed to this result. The amount ingested on the day of hard crying was less than on the day of minimal metabolism in the other three. In the table wherever no actual basal periods occur, the percentage of crying activity is reckoned as the difference between the longer and shorter periods of activity to correspond with the difference in metabolism between the two. It is the more convincing therefore that the average effect of crying should prove to be nearly in agreement with that found in Table 5. Forty-five per cent. of the time spent in crying raises the metabolism 49 per cent. The lower metabolism (minimal) taken as the standard as well as a greater intensity of crying is responsible for this result. Averaging together the results in the two tables, we find that 32.1 per cent. of crying activity raises the metabolism 31.7 per cent. In brief, it appears that crying 1 per cent. of the time raises the metabolism 1 per cent. This statement answers the second question propounded at the beginning of this section. Exceptions both ways balance each other. The mean effect is possibly significant of some underlying principle governing the muscular capacity in the new-born.

In answer to the first question propounded in the foregoing, so far as the present series of observations goes, the greatest intensity of crying recorded was nearly double the average intensity. The metabolism was raised (over the minimal) 117 per cent. by crying only 63 per cent. of the time. Any statement of the effect of crying on metabolism which does not include the percentage of time spent in crying is of little value.

On the third question, as to the efficiency of infant's muscles compared with those of the adult, we have no direct observations. Interesting calculations on this phase of energy metabolism in infancy have been made by Schlossmann and Murschauser,[21] but they have assumed an efficiency of 33 per cent. in the conversion of the potential energy of food to mechanical work, a value rarely attained under optimum conditions in the adult. There is little profit in estimating the total amount of mechanical work which a child might perform by crying twenty-four hours on any basis of efficiency, for a child never cries for twenty-four hours. It may serve some purpose, however, to try to visualize the work equivalent of the metabolism caused by crying all the time. On the basis established in the foregoing, the average child would exactly double his metabolism, and in the present series this would mean an increase of 6.67 calories per hour. The work equivalent of this amount of heat would be 2,854 kilogram meters. Assuming an efficiency of 20 per cent. (better than the best steam railway locomotive) the child would do an amount of work equivalent to lifting in one hour 570 kg. one meter high or lifting his own weight (3.5 kg.) to the top of the Washington monument. This is an astonishing amount of energy but it would be accomplished with only 10 c.c. of his mother's milk!

Which constituent of the milk is most efficient in supporting the muscular effort of crying? The recent work of Krogh and Lindhard [22] demonstrates that in the adult carbohydrate is 11 per cent. more efficient than fat for this purpose. This difference rests on the chemical transformations necessary to make the fuel energy available to the muscles, and there is no reason to believe that these chemical changes are different in the child. In a few of our observations it is noticeable that when a child cries on the second or third day, before the breast has begun to supply food in sufficient quantity to meet the child's needs and after his own store of glycogen has been exhausted, the metabolism is increased more than in a similar or even a longer period of crying after the food supply is adequate. For example, Child 20 on the second day, after no food, cried only two and three minutes out of sixty (3 per cent.) but the metabolism was between 32 and 35 calories per square meter. On the fourth day after a good feeding of breast milk and 10 per cent. lactose

21. Schlossmann, A.: Monatschr. f. Kinderh. Orig. **12**:47, 1913.
22. Krogh, A., and Lindhard, J.: Biochem. J. **14**:290, 1920.

(see Table 2) crying an equal amount gave a metabolism of only 25 to 28 calories per square meter. The body temperature and all other conditions were the same. Again, Child 35 on the second day, after no food cried four minutes out of fifty-three (7 per cent. of the time) but showed a metabolism of 34 calories per square meter, while on the fourth day after breast milk and 10 per cent. lactose, crying eleven minutes out of forty-six (24 per cent.) gave a metabolism of only 31 calories per square meter. The body temperature (Table 2) was lower on the second day. Child 39 on the second day, after no food, cried three minutes out of forty-eight (6 per cent. of the time) and showed a metabolism of 32.78 calories per square meter, while on the third day after 34 gm. of 10 per cent. dextrose it cried nineteen minutes out of forty-three (44 per cent.) and yet gave a metabolism of only 39.42 calories per square meter.

These differences suggest a lower efficiency of body fat (low respiratory quotient) than of carbohydrate in the form either of lactose or dextrose in supporting the muscular effort of crying. Indeed, if they were to be taken without qualification they would go far to justify on purely physiologic grounds the practice of giving sugar solution before the milk appears. The observations here reported are too fragmentary to be more than suggestive. They are presented only for the sake of directing the attention of obstetricians and pediatricians to this aspect of the matter of supplementary feedings.

THE INFLUENCE OF FOOD ON THE ENERGY METABOLISM

The plan of study adopted in this investigation contemplated: (1) the comparison of the metabolism before and after feeding on the same day; (2) the effect of supplementary feedings on the respiratory quotients particularly on the second and third days when the quotient is lowest; (3) the dynamic action of artificial feeding as compared with breast milk; and (4) the difference in the dynamic action of small and large feedings.

It is obviously necessary to have true "basal" periods for any one of these objects. The first naturally presented the greatest difficulties. There were instances of true basal conditions, namely, quiet sleep, even without any food (compare Cases 11, 12, 45 and 50, Table 2) but in no child did we succeed in securing these conditions both after "no feeding" and after a known amount of food on the same day. The nearest approach was with Case 50 where a true basal was obtained without food on the first day and a true basal again on the third day after 30 gm. of 10 per cent. lactose. There seems to be a dynamic effect here but the average "basal" as we have seen is lower for the first than for the third day. With Cases 11 and 12 basal conditions after "no

feeding" on the first and eighth days can be compared with similar conditions (equally quiet sleep) after feedings of breast milk on the fifth and eleventh days respectively. In both instances the basal metabolism is lower after the breast feeding. This experience recalls that of Rubner and Heubner,[23] Schlossmann and Murschauser[24] and of Howland[2] in their attempts to obtain the true fasting metabolism. The infants were fed tea or tea and saccharin, both of which substances conceivably could influence the result. Nevertheless the metabolism each time was greater in fasting than after food, although the infants slept apparently as well in the fasting period. Probably they did not sleep actually as well, that is, as quietly as after food. Food soothes the nervous system of a child and probably tones down the reflex centers as well as the peripheral mechanisms.[25]

Reference has already been made to the absence of effect of supplementary feedings on the respiratory quotient, when all of the results are averaged together for the first few days. Many individual instances of this may be cited after breast feeding as well. For example, with Case 11 (Table 2) on the first day the quotient in two periods after "no feeding" was 0.78 and 0.76. Next day after 56 gm. breast milk it was 0.72 and 0.73.

Even on the fifth day when the two periods were basal, as on the first, the quotient after 1 ounce (30 gm.) of breast milk was only 0.73 and 0.77. With Case 17 with feedings up to 45 gm. of breast milk recorded, the quotient never rose in our observations, which extended to the tenth day, higher than 0.77. Without looking at the weight curve one could be sure in a case of this kind that there had been no substantial growth. The breast obviously was not producing enough to satisfy the baby's needs. There are three instances (Cases 20, 30 and 39) two on the third day, and one on the second, where a feeding raised the quotient materially over what had been found earlier in the day in a "no feeding" observation. But there are several others (Cases 38, 41, 42 and 43) where a feeding following "no feeding" or following only a small feeding failed to do so. Indeed we gained a strong impression that it was very difficult by any kind of feeding unless it were large in amount or unless it followed one of substantial amount, to raise the quotient on these two days. This does not signify that the infant is unable to oxidize the sugars on these days, but only that it requires substantial amounts of food to keep the tissues at that point of saturation with glycogen where any addition supplies a surplus which may enter into combustion at once. Nor does the failure to produce a rise in quotient signify that a supplementary

23. Rubner, M., and Heubner, O.: Ztschr. f. Biol. **36**:1, 1898.

24. Schlossmann, A., and Murschauser: Biochem. Ztschr. **26**:14, 1910.

25. Gertsley, J. R., and Hoskins, R. G.: A Study of the Effect of Hunger on Nervous Irritability, Am. J. Dis. Child. **15**:336 (May) 1918.

feeding of sugar serves no purposes. There are many synthetic chemical reactions concerned in growth where sugar enters into the formation of new tissue. The favorable effect of supplementary feedings in preventing loss in weight from the second to fifth day is perceptible in several of the cases (compare Cases 16, 17, 20, etc.). To insure against this loss, however, it is necessary to keep the nutrition up to the point where a substantial feeding is followed by a rise of quotient. Indeed, without looking at the weight record, one can readily pick out the babies which were growing satisfactorily by inspection of the records for the respiratory quotient. Wherever a substantial feeding raises the quotient to the neighborhood of 0.90 or over, one may be certain that glycogen is present in reserve and this means that the tissues have not recently been depleted. Regard must be had of course to the effect of crying on the respiratory quotient as indicated in a previous section.

The dynamic action of the food can only be judged where the conditions are basal. Owing to the difficulty of securing these conditions without food, we have been obliged to be content with the comparison of the effects of feeding in different amounts. All such cases have been assembled in Tables 7 to 9. The first compares feedings in different amounts in the same person. Unfortunately, not all are observations on the same day. In four cases, however (Cases 40, 42, 46 and 47), the observations were immediately consecutive, one in the forenoon and

TABLE 7.—*Effect of Food in Different Quantities*

Case	Age	Feeding	Period	Respiratory Quotient	Heat per Sq. Meter Hourly	Heat per Kg. Hourly	Activity
16	3	24 gm. B. M.	2	0.79	25.83	1.74	B
	4	48 gm. 5% lactose	2	0.80	28.24	1.91	B
31	2	A little 10% lactose	...	0.72	31.55	2.19	S. R.
	3	32 gm. B. M.	1	0.75	31.21	2.16	B
			2	0.75	32.07	2.22	B
32	4	31 gm. B. M.	1	0.71	27.19	1.80	B
	5	67 gm. B. M.	1	0.78	28.93	1.88	B
35	6	26 gm. 10% lactose	1	0.72	27.88	2.03	B
			2	0.66	26.84	1.95	B
	7	37 gm. 10% dextrose	1	0.71	29.37	2.13	B
			2	0.73	28.29	2.06	B
46	2	14 gm. B. M.	1	0.67	29.52	2.13	B
	3	26 gm. 10% lactose	1	0.72	33.28	2.39	B
47	2	10 gm. B. M.	2	0.70	27.71	1.96	B
	3	27 gm. 10% lactose	2	0.74	28.69	2.03	B
50	11 hrs.	No food	1	0.83	29.90	1.92	B
			2	0.73	28.64	1.84	B
	3	30 gm. 10% lactose	1	0.70	32.84	2.15	B
			2	0.72	31.13	2.04	B
42	3	A little B. M.	1	0.72	33.59	2.34	B
			2	0.82	26.36	1.84	B
	3	36 gm. 10% lactose	1	0.80	30.58	2.13	B
			2	0.73	31.50	2.19	B
29	5	B. M., amount not recorded	1	0.73	31.80	2.32	B
			2	0.68	26.49	1.96	B
	7	23 gm. formula	1	0.89	24.34	1.76	B
40	3	47 gm. 10% lactose	1	0.84	29.64	2.02	B
			2	0.65	29.10	1.98	B
	3	46 gm. B. M.	1	0.70	34.42	2.34	B
			2	0.68	26.59	1.81	B

TABLE 8.—*Effect of Small Feedings*

Case	Age, Days	Feedings	Period	Heat per Sq. Meter Hourly	Heat per Kg. Hourly	Activity
11	5	28 gm. breast milk	...	29.76	2.11	B
12	11	28 gm. breast milk	...	30.07	2.07	B
16	3	24 gm. breast milk	...	25.83	1.74	B
16	5	37 gm. breast milk and some lactose	...	25.33	1.71	B
17	2	7 gm. breast milk	...	28.80	1.80	B
17	7	28 gm. breast milk	1	25.62	1.66	B
17	7	28 gm. breast milk	1	26.29	1.70	B
			2	25.04	1.66	B
32	4	31 gm. breast milk	1	27.19	1.80	B
33	1	28 gm. 10% lactose	...	25.79	1.72	B
34	3	21 gm. B. M. and some lactose	...	28.02	1.94	B
35	6	26 gm. B. M.	1	27.88	2.03	B
			2	26.84	1.95	B
	7	37 gm. 10% dextrose	1	29.37	2.13	B
			2	28.29	2.06	B
46	2	14 gm. B. M.	...	29.52	2.13	B
47	2	10 gm. B. M.	2	27.71	1.96	B
	3	27 gm. 10% lactose	1	30.73	2.17	B
			2	28.69	2.03	B
Average..	4.5	26.7 gm. food	...	27.73	1.91	

TABLE 9.—*Effect of Large Feedings*

Case	Age, Days	Feedings	Period	Heat per Sq. Meter Hourly	Heat per Kg. Hourly	Activity
13	7	55 gm. breast milk	1	32.24	2.54	B
			2	32.12	2.53	B
16	4	48 gm. 5% lactose	1	28.24	1.91	B
19	8	51 gm. breast milk	1	27.40	1.87	B
			2	24.42	1.67	B
32	5	67 gm. breast milk	...	28.93	1.83	B
40	3	47 gm. 10% lactose	1	29.64	2.02	B
			2	29.10	1.96	B
	3	46 gm. breast milk	1	34.42	2.34	B
			2	26.57	1.81	B
41	...	41 gm. 10% lactose	1	34.50	2.16	B
43	3	54 gm. 10% lactose and breast milk	1	26.90	1.71	B
				30.54	2.02	B
Average	4.5	51 gm. food: breast milk or lactose, or both		29.61	2.03	
From Table 8	4.4	26.7 gm. food: breast milk or lactose, or both		27.73	1.91	

Average difference due to 24 gm. food, 1.88 calories = 6.8 per cent.

the other after the next feeding in the afternoon of the same experiment day. All of these except Case 40 exhibit a higher heat production following the larger feeding. In the latter case a feeding of breast milk equal to the feeding of 10 per cent. lactose given in the morning raised the metabolism the first hour although the quotient was lower. This would probably mean that the breast milk was rich in fat or that the child had unusual capacity for utilizing this constituent promptly. The other cases in the table, except Case 29, all show a larger feeding on the next day. The difference is very small, in some cases not beyond the limit of error, which as noted in an early paragraph is not more than 5 per cent. on the oxygen alone. Differences due to unequal repose on successive days were against the dynamic action in all except Case 50.

Moreover, in each case except Case 35, the average basal, without regard to the amount of food (see Table 4) is smaller on the second day compared.

The largest effects on heat production shown in Table 7 are from feeding lactose. With Case 46 feeding approximately twice as much 10 per cent. lactose as of breast milk raised the metabolism about 12 per cent. With Case 16 a like increase in the feeding of 5 per cent. lactose over breast milk raised it 10 per cent. With Cases 47 and 42 the increase is only about 5 per cent. The reference to percentage increase is to the metabolism per square meter of surface. Doubling the feeding of breast milk in Case 32 did not raise the metabolism more than 7 per cent. All in all, these comparisons show that the range of dynamic effect from feeding either sugar solutions or breast milk is from 5 to 12 per cent.

In Tables 8 and 9 all the truly basal periods are brought together after giving "small" and "large" feedings respectively. A small feeding is arbitrarily designated as any amount of either milk or sugar solution amounting to 40 gm. or less, and a large feeding as anything over this amount. The average of the small feedings is 26.7 grams and the average of large feedings is 51 grams. The average difference in heat production per square meter per hour is 1.88 calories, or 6.8 per cent. It happens also, without design, that the average age in the two groups is almost identical. It seems fair therefore to say that the addition of 24 grams of food, whether breast milk or lactose or dextrose solution, to a small feeding will raise the metabolism within the first two hours and a half after feeding approximately 7 per cent. So early an effect from milk must be due mainly if not wholly to the sugar of milk. This is the nearest we can approach a statement of the dynamic effect of food from our present study. The difficulties surrounding any attempt of this sort, while keeping strictly within the normal limits for new-born babies will be fully appreciated by our readers.

SUMMARY

1. Some improvements in the respiration apparatus, designed to make measurement of oxygen absorption more accurate are described.

2. The maximum error in the measurement of oxygen and therefore on the heat production is approximately 5 per cent.

3. Two hundred and thirty-four observation periods on fifty new-born infants, ranging in age from 6 hours to 15 days are recorded.

4. Of this number only ninety-eight periods with thirty-eight infants may be described as truly basal, i. e., when the infant slept quietly throughout.

5. The basal metabolism for these thirty-eight infants averages 6.67 calories per hour, or 2.00 calories per kilogram and 29.16 calories per square meter (Lissauer) per hour.

6. The respiratory quotient in these basal periods ranges from 0.66 to 1.16. The average of all quotients whether basal or not is from 0.79 the first twenty-four hours to 0.75 on the fourth, thence gradually upward to 0.85 on the ninth day.

7. The basal heat production is highest in the second twenty-four hours. From this point it falls gradually and uniformly on the basis of surface to the sixth day, from which point it again rises steadily.

8. Applying statistical methods, it is found that surface area is as usual a slightly better measure of basal metabolism than body weight.

9. Again, on the basis of statistical methods it is found that, lumping all observations together, there is practically no correlation between heat production and the pulse rate.

10. With regard to the influence of crying on energy metabolism the interesting observation is made that in the average infant, active, healthy crying requires just as much again expenditure of energy as the basal (sleeping) metabolism. Expressed differently, crying 1 per cent. of the time raises the metabolism 1 per cent.

11. Especial attention has been given to the effects of natural food and of supplementary feedings of lactose and dextrose solutions on the respiratory quotient and on the basal heat production. It has been found particularly difficult to raise the respiratory quotient by means of single supplementary feedings on the second and third days. The respiratory quotient accurately determined, however, may be taken as an index of the state of nutrition. If sufficient supplementary food is given to insure a respiratory quotient of 0.90 or above, within two hours and a half after feeding the state of nutrition will be good and the child will be gaining weight.

12. The dynamic action of ordinary feedings or of supplementary feedings within the first eight days is very small. The largest recorded was 12 per cent. from a feeding of 10 per cent. lactose. It is about the same from dextrose. Comparing the effect of small feedings (averaging 26.7 grams) of food or of the sugar solutions with that of large feedings (averaging 51 grams) the increase in the basal heat production, due to the addition of 24 grams, is approximately 7 per cent. (average).

STUDIES IN TUBERCULOSIS

IV. SIGNIFICANCE OF LYMPHANGITIS OCCURRING WITH CUTANEOUS TUBERCULIN TESTS IN CHILDREN *

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In the course of routine cutaneous tests with tuberculin in children, it was observed that lymphangitis developed in certain instances. This local manifestation varied in severity and extent and was accompanied by constitutional reactions.[1] Within from twenty-four to forty-eight hours after the cutaneous test, a streak of lymphangitis developed in relation to the positive local reaction as an extension along the lymph channels of the forearm. The possibility of faulty technic was excluded by rigid aseptic precautions at all stages of the test and by sterility of the tuberculins which were used. The significance of the phenomenon became apparent later from a supplementary study of the clinical, physical and roentgen-ray findings, and these observations suggest that lymphangitis occurring with cutaneous tuberculin tests in children is pathognomonic of tuberculosis with an active focus of glandular origin. In a series of cases of adult tuberculosis, the same observations confirmed the relation of this reaction to focal tuberculosis.

NATURE OF THE LYMPHANGITIS REACTION

The extent of the lymphangitis was variable, at times quite severe, and frequently it was not necessarily associated with an equally violent local reaction to the tuberculin. The red streak measured from 2 to 10 cm., or more, in length and varied from a limited lateral or medial extension of an indurated and erythematous area to that of an infiltrated lymphogenous band, which coursed upward on the arm and beyond the antecubital space to the axilla (Figs. 6 to 10). Adjacent lymph glands became indurated and definitely palpable, and a rise in temperature of one or more degrees accompanied the reaction. The lymphangitis faded usually within seventy-two hours and disappeared without treatment after from forty-eight to ninety-six hours. These reactions could be elicited again when tests were made subsequently in the same patients.

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* Received for publication, Nov. 17, 1924.

* From the Department of Medicine, University of California.

* The major part of this work was done at the Glen Lake Sanatorium, Oak Terrace, Minnesota, under a grant from the Hennepin County Tuberculosis Association of Minneapolis.

1. Eberson, Frederick: Significance of Constitutional Reactions Following Tuberculin Tests, Arch. Int. Med. (in press).

CLINICAL INVESTIGATION

The tuberculin tests were applied according to the established Pirquet technic which has been described in a previous publication.[2] Reactions were read from twenty-four to forty-eight hours after the test and thereafter until they had faded completely. Bovine and human tuberculins were used primarily, and in a number of patients tests were made with some of the derivatives of tuberculin: acetyl O.T. and "ether-insoluble X" substance, which have been discussed elsewhere.[3] A total of 135 juvenile patients were studied and a series of adult patients numbered ten.

Eighteen children (13.3 per cent.) reacted with an associated lymphangitis to cutaneous tuberculin tests. Four adults, in whom glandular tuberculosis accompanied pulmonary involvement or tuberculous peritonitis, reacted in a similar positive manner (40 per cent.).

CLINICAL FINDINGS AND DIAGNOSIS

All of the juvenile patients had a definite history of exposure to tuberculosis. One or both parents or a near relative had the disease and contact had been proved. In other instances direct infection was established through milk from tuberculous cattle.

The symptoms in all were typical of juvenile tuberculosis, with a history of lassitude, loss of weight or failure to gain, chronic "colds," cough or hoarseness, irritability, lack of appetite, profuse sweating of unknown origin and periods of rise in temperature which was otherwise unaccounted for.

Hilum tuberculosis was diagnosed in twelve and tuberculous adenitis with hilum involvement in four patients. One of the former group developed parenchymal tuberculosis a few months later. In one child an old tuberculous empyema with residual pleurisy was present, and in another Pott's disease was diagnosed.

PHYSICAL FINDINGS

As is usual in juvenile tuberculosis, the physical findings were never striking. Cervical adenopathy was present universally, and in a large number the submaxillary, axillary and inguinal glands were palpable. Of some significance was the frequent occurrence of supraclavicular adenopathy. Paravertebral dulness was elicited in all of the patients.

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2. Eberson, Frederick: Clinical Study of Tuberculin Reactions with New Derivatives of Tuberculin, Am. Rev. Tuberc. (in press).

3. Eberson, Frederick: Diagnostic and Sensitizing Properties of Some New Derivatives of Tuberculin, Am. Rev. Tuberc. (in press); Studies in Tuberculosis Immunity, Proc. Soc. Exper. Biol. & Med. **21**:539-543 (May 8) 1924.

In one only was parenchymal tuberculosis encountered, and this manifested itself as a later development in the course of a typical hilum tuberculosis which became complicated with pneumonia.

ROENTGEN-RAY STUDY

Roentgenologic studies demonstrated in 100 per cent. of the cases a complete correlation between the positive tuberculin reaction associated with lymphangitis, and tuberculous foci in the hilum or intrapulmonary glands. These observations gained additional support from the presence, in several cases, of cervical gland involvement. Conclusions may be drawn from the following series of roentgen-ray pictures.

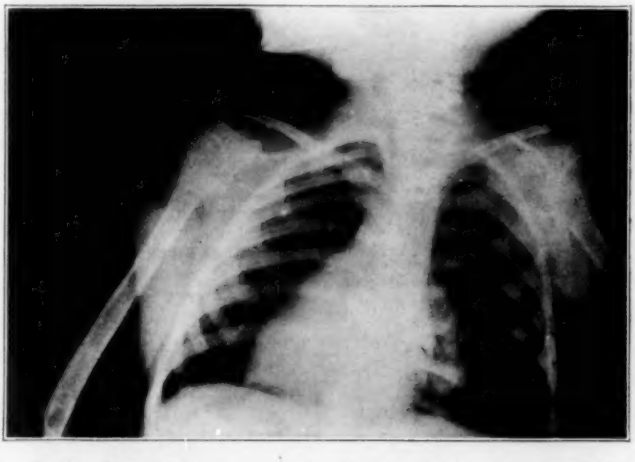

Fig. 1.—C. K. Tuberculous cervical adenitis. Tuberculin reaction is shown in Figure 6.

REPORT OF CASES

Case 1.—C. K., aged 5 years, had an enlarged caseous gland in the right base; enlarged tracheobronchial glands in the right hilum, and apical pleurisy on the right side (Fig. 1).

Case 2.—M. B., aged 4 years, had a large tracheobronchial gland clearly visualized in the second left interspace behind the second and third ribs; enlarged and calcified hilum glands on the right side.

Case 3.—V. G., aged 10 years, had a markedly enlarged bronchial gland with some calcification in the left hilum; small calcified glands in the left hilum, and a primary focus in the second left interspace close to the root of the lung.

Case 4.—S. B., aged 10 months, had markedly enlarged and calcified hilum glands on the right side and moderately enlarged and calcified glands on the left.

Case 5.—W. S., aged 5 months, had marked enlargement of the hilum glands with calcification on the left side; many small areas of calcification in the lower and middle portions of the right lung field ascending from the hilum. These calcified areas were interpreted as primary foci of tuberculosis by the

roentgenologist. Seven months later, roentgen-ray plates showed definitely enlarged bronchial glands on the left side, with a diffuse pulmonary tuberculosis of the right upper and middle lobes (Figs. 2 and 3).

CASE 6.—M. P., aged 7 years, had calcification and enlargement of the bronchial glands on the left side (Fig. 4).

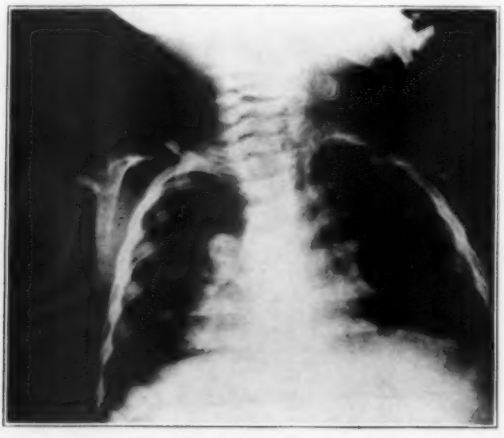

Fig. 2.—W. S. Hilum tuberculosis with enlarged cervical glands. This plate was made seven months prior to the one shown in Figure 3.

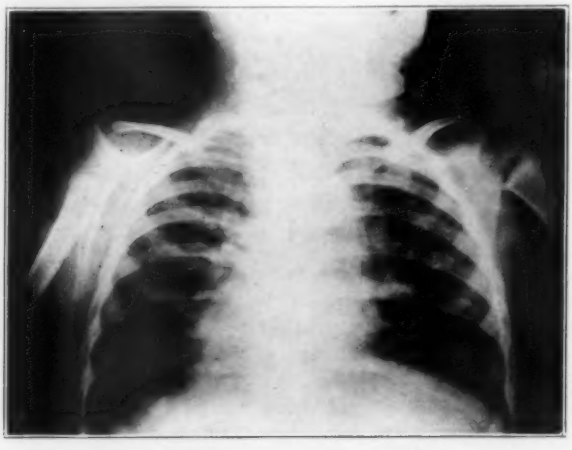

Fig. 3.—Same patient as in Figure 2, seven months later, showing the diffuse pulmonary tuberculosis in the right upper and middle lobes.

CASE 7.—P. K., aged 8 years, had a markedly thickened pleura in the left lower lung and axilla, the remains of an old tuberculous empyema.

CASE 8.—E. D., aged 9 years, had calcified hilum glands on both sides.

CASE 9.—C. S., aged 3 years, had marked enlargement of the hilum glands on both sides.

CASE 10.—E. T., aged 7 years, had calcified primary focus in the second interspace on both sides; enlarged tracheobronchial glands on both sides.

CASE 11.—V. V., aged 8 years, had calcification of primary focus in the second left interspace; enlargement and calcification of hilum glands on the left side (Fig. 5).

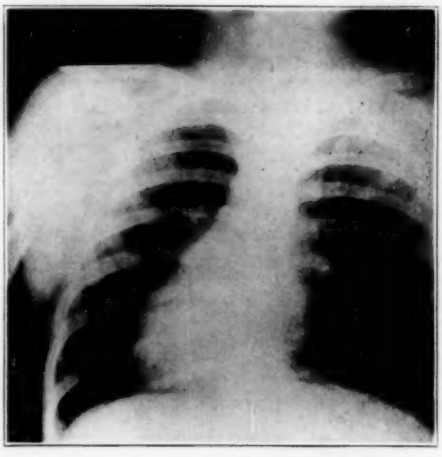

Fig. 4.—M. P. Hilum tuberculosis.

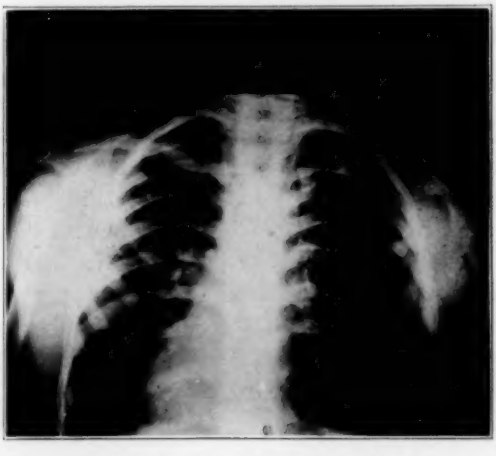

Fig. 5.—V. V. Hilum tuberculosis.

CASE 12.—L. P., aged 10 years, had enlargement and calcification of bronchial glands; calcified gland in the parenchyma of left apex and in right middle lobe.

CASE 13.—E. W., aged 16 years, had considerable peribronchial thickening in the right upper lobe and toward the right base; markedly enlarged bronchial glands; peribronchial tuberculosis of right upper lobe; calcified hilum glands.

CASE 14.—L. P., aged 10 years, had a calcified gland in the parenchyma of the left apex and in the right middle lobe; enlargement and calcification of the bronchial glands.

CASE 15.—O. G., aged 9 years, had considerable calcification in each hilum, most marked in the right; several calcified nodules extended from the right base to the periphery. Hilum tuberculosis, with primary focus in right base.

CASE 16.—A. H., aged 10 years, had two large calcified glands in the upper end of the right hilum and smaller calcified nodules along the thickened bronchi extending outward from this region. At the right base there were calcified nodules and toward the right top the mediastinal pleura was thickened.

CASE 17.—A. F., aged 13 years, had small calcified nodules near the center of the right lung field; localized thickening at the upper end of the left hilum with marked thickening along the bronchi toward the left top; definite increase in density of the hilum shadows.

CASE 18.—J. Q., aged 15 years, had definite thickening at the hilum of each lung with most marked changes on the right; peribronchial thickening extending far outward to the periphery throughout both lung fields.

The roentgen-ray findings are especially convincing in the series of cases which have been tabulated here. In seventeen out of eighteen patients the plates were indubitably diagnostic from the standpoints of marked enlargement of the hilum or intrapulmonary glands, calcification, tracheobronchial adenopathy or other significant criteria. The single exception to this uniformity of results proved to be one in which the hilum glands only were bilaterally enlarged, but in this case other evidence served to establish the diagnosis. Experience has shown that the majority of cases of tuberculosis in childhood can be diagnosed by tuberculous glands in the hilum of the lungs. At least 90 per cent. of juvenile tuberculosis cases will show a focus in these glands. It is admitted that there is difficulty at times in interpreting the picture, especially since diseases of the upper respiratory tract and of the lungs may produce a degree of glandular enlargement of varying duration. However, a pronounced swelling of the hilum glands, particularly when the adenopathy ranges toward the mediastinum and lungs, favors the diagnosis of tuberculosis. Obviously, calcification and caseous degeneration are especially important from the diagnostic standpoint, and the former may be considered pathognomonic of tuberculosis. Where a more advanced tuberculous process exists, the picture of parenchymal changes differs not at all from what may be seen in adult processes. This condition is not usually encountered, and the mechanism by which such extension occurs from an initial hilum tuberculosis is still a moot question, although there seems to be ample evidence to support the belief that direct lymphogenous extension is a decisive factor. The comparative plates in the case of W. S. (Case 5, Fig. 3) illustrate the manner in which a parenchymal tuberculosis may develop subsequent to a simple hilum involvement. When these roentgen-ray findings are correlated with a positive history of exposure to tuberculosis, unequivocal tuber-

culin reactions and a definite clinical picture, an interpretation may be vouchsafed with more or less assurance. The meaning of the lymphangitis subsequent to a tuberculin test becomes significant when evaluated in terms of all of these critical and pointed facts.

TUBERCULIN REACTIONS

The following cases illustrate several typical examples of reactions which followed cutaneous tuberculin tests.

CASE 1.—C. K., a boy, aged 5 years, had the diagnosis of tuberculous cervical adenitis. Reactions to bovine and human tuberculins were positive. Subsequent tests which were made one month later with "ether-insoluble X" substance and acetyl O.T., gave pronounced reactions. The former measured 2.5 by 3.0 cm. with a lymphangitis streak 5 cm. in length and 1 cm. in width. The acetyl derivative reacted violently over an area of 2.0 by 2.0 cm., with an accompanying streak of lymphangitis 4.0 cm. long and 0.75 cm. wide (Fig. 6).

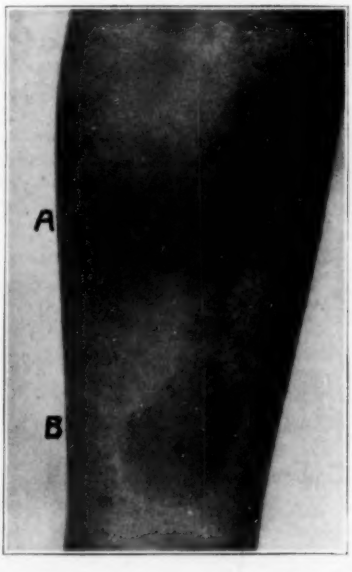

Fig. 6.—C. K. Tuberculin reactions and lymphangitis. Ether-insoluble X substance (A); acetyl derivative (B).

CASE 2.—S. B., a girl, aged 2 years, had a diagnosis of Pott's disease. This patient was tested with human tuberculin and one month later with acetyl derivative and "ether-insoluble X" substance. The human tuberculin gave a sharp reaction over an area of 4.0 by 5.0 cm., with an elevated central zone of 1.5 by 1.5 cm. A streak of lymphangitis extended upward from the upper peripheral area for a distance of several centimeters (Fig. 7).

CASE 3.—P. K., a boy, aged 8 years, had a diagnosis of old tuberculous empyema and residual pleurisy. Bovine and human tuberculin tests were positive on several occasions. In subsequent tests which were made one month later with "ether-insoluble X" substance and acetyl O.T. derivative, very marked reactions were produced. The acetyl preparation was positive over an area of 2.5 by 4.0 cm., and a lymphangitis streak extended upward for 2.5 cm.

above the erythematous border. The entire lesion was markedly infiltrated and reddened. The "ether-insoluble X" substance gave a pronounced reaction over an area of 1.2 by 1.5 cm., with a surrounding erythema of 2.5 by 3.0 cm. which blended with the reaction zone of the acetyl derivative (Fig. 8).

CASE 4.—V. G., a boy, aged 10 years, had a diagnosis of hilum tuberculosis. Pirquet tests with bovine and human tuberculins and acetyl derivative were positive in May, 1924. A marked lymphangitis was present at this time. Six weeks later the tests were repeated with "ether-insoluble X" substance. An area of reddening and infiltration 1.75 by 1.5 cm. in extent resulted, with a streak of lymphangitis which coursed along the anterior and inner aspects of the forearm. An enlarged and painful lymph gland was palpated readily on the inner aspect of the arm in the lymphatic channel. The site of the reaction and its surrounding area were painful and tender to touch, and induration was present over a surface of from 2 to 3 cm. surrounding the local lesion (Fig. 9).

CASE 5.—A. F., a boy, aged 13 years, had a diagnosis of hilum tuberculosis. Pirquet tests were strongly positive after twenty-four hours. Bovine tuberculin produced an area of marked induration and reddening 1.0 by 1.0 cm., and an erythematous zone 2.0 by 4.0 cm. A streak of lymphangitis extended up as far as the axilla (see Figure 10). Human tuberculin gave a mild reaction over an area 0.75 by 1.0 cm. with an areola 2.0 by 2.0 cm.

CASE 6.—J. Q., a boy, aged 15 years, had a diagnosis of questionable hilum tuberculosis. Bovine tuberculin gave a violent reaction over an extent of 2.5 by 2.5 cm. with marked reddening, infiltration, induration and a bright red streak of lymphangitis extending as far as the axilla. The arm was painful to touch and axillary adenopathy was present. Human tuberculin was positive over an area of 1.0 by 1.0 cm., slightly reddened and moderately indurated.

ADULT TUBERCULOSIS AND LYMPHANGITIS

A series of adult patients with definitely diagnosed tuberculosis served as a control, and substantiated the results which were obtained in the juvenile series. Ten cases included different stages of unilateral and bilateral pulmonary tuberculosis, tuberculous peritonitis, and tuberculosis of the bones, joints and glands. Tuberculin tests were strongly positive in all of these, and in six cases there were marked constitutional reactions with associated lymphangitis of unusual severity. These reactions were obtained not only with ordinary human tuberculin but also with acetyl and benzoyl derivatives and "ether-insoluble X" substance. At the height of these manifestations there were tenderness and great swelling of the lymph glands along the lymphatic tract extending into the axilla, where the glands were exceedingly painful and indurated. The reactions subsided after from three to four days, in the course of which recession of adenopathy and of the local changes occurred simultaneously with a drop in temperature. The type of lymphangitis is illustrated in Figure 10. In this particular case "ether-insoluble X" substance was used for the tuberculin test, and was characteristic of the reactions which had been obtained on numerous other occasions.

Fig. 7.—S. B. Tuberculin reaction and lymphangitis with ether-insoluble X substance.

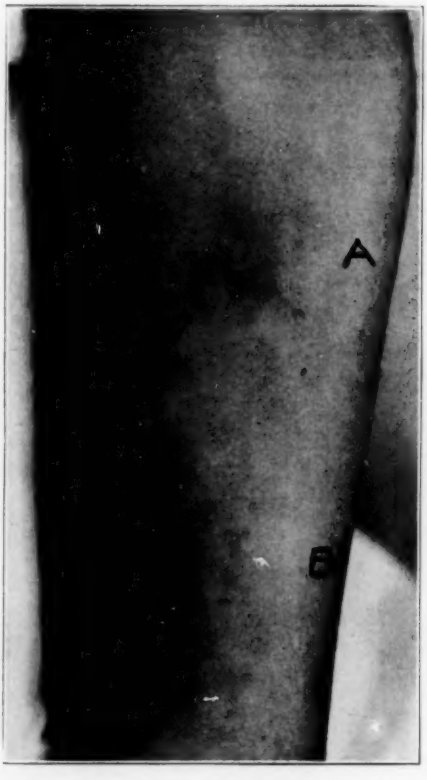

Fig. 8.—P. K. Tuberculin reactions and lymphangitis with acetyl derivative (A), and ether-insoluble X substance (B).

COMMENT

The obvious deduction from this clinical and experimental study of tuberculin reactions and associated lymphangitis is that the phenomenon is specific and has some diagnostic as well as theoretic significance. An interpretation of this observation presupposes a knowledge of facts which may have some bearing on the mechanism of a tubercle infection in relation to lymphatics and lymph glands. A search of the literature fails to bring forth pertinent data regarding lymphangitis in relation to the phase of our problem. It was Cohnheim who pointed out long ago that the tubercle bacillus leaves its mark on the lymph glands and the afferent trunks which drain the site of entry of the infection.

Fig. 9.—V. G. Tuberculin reaction and lymphangitis with ether-insoluble X substance.

Quite recently, Herring and MacNaughton[4] claim to have confirmed this dictum in a study of the part played by the lymphatics in the spread of certain diseases. In particular, tubercle bacilli were found to take a direct path to the proximal gland in their course along the lymphatics by means of phagocytic cells. In this process some organisms are destroyed while those that are not give rise to a tuberculous

4. Herring, P. T., and MacNaughton, F. G.: Lancet **1**:1081 (June 3) 1922.

focus in the lymph gland. The toxin which is produced by the bacilli causes lymphocytosis, which in turn serves to reduce the vulnerability of an adjacent gland as a result of a narrowing of the sinuses. It is not mere speculation to aver that such a mechanism entails local as well as a more widespread sensitization, of which the phenomenon of lymphangitis appears to be an objective demonstration. Further, it is of interest

Fig. 10.—C. W. Tuberculin reaction and lymphangitis in adult pulmonary tuberculosis. Ether-insoluble X substance was used in this test.

in this connection to consider the question of what relation, if any, exists between the severity of a tuberculin reaction and the specific infection with tuberculosis. Having observed and described the occurrence of constitutional reactions and lymphangitis in undoubted cases of juvenile tuberculosis and adult tuberculous infections, it would seem

that there is some justification for stressing the value of correlated findings, such as a severe tuberculin reaction and the presence of the disease. By some, this line of reasoning is discarded for an hypothesis which tends to nullify whatever confirmatory evidence happens to be available. The amount of reaction to tuberculin is said to correspond directly to the vigor and irritability of the body, of which the irritability to tuberculin is merely a part. Thus McNeil [5] would support the idea of Escherich who, in 1909, pointed out that severe tuberculin reactions depended on status lymphaticus which existed before an infection with tuberculosis occurred. Strangely enough, Escherich invoked the aid of clinical findings which discounted rather than supported his contention that a "scrofulous diathesis," with lesions of tuberculous lymph glands of the neck and abdomen and tuberculosis of the bones, increased the sensitiveness to tuberculin and other nontuberculous irritants. Since he was describing tuberculosis and not lesions which were due, as he thought, to status lymphaticus, these conclusions appear erroneous.

The significance of lymphangitis with tuberculin reactions is to be considered, therefore, from the standpoint of an infection with tuberculosis which in children manifests itself as a glandular disease. The lymphatics are the distributors and the phenomenon of lymphangitis speaks for an active tuberculous process. A glandular reaction following an injection of tuberculin is akin to a more pronounced skin reaction and is in turn an integral part of the most pronounced reaction, lymphangitis, which results from an active sensitization of the lymph channels to the products of the tubercle bacillus.

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5. McNeil, C.: Brit. J. Child. Dis. **20**:197, 1923.

TRANSITORY CONGESTIVE THYROID ENLARGEMENT *

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In our work for the last few years at the Mount Sinai Pediatric Clinic, we have observed a condition of the neck that does not seem to correspond with any of the known clinical entities in that region and yet which simulates them very closely.

Five children have been seen to date who have had this condition of the neck. Their histories follow.

REPORT OF CASES

CASE 1.—H. W., a boy, aged 6 years and 6 months, was brought to the clinic for the treatment of enuresis and the presence of a transiently appearing tumor of the right side of the neck.

Family History.—Negative.

Past History.—The child was born at term, of normal delivery and breast fed for 15 months with mixed feeding thereafter. He had measles at 3 and chickenpox at 5 years and pertussis at 5 years. He first walked and talked at 16 months and had been vaccinated when aged 5 months.

Present Illness.—The patient's mother claims to have noticed a transient bulging of the right side of the neck since birth, which became more prominent on crying, coughing and vomiting. This transient tumor increased in size as the child grew older. With the onset of pertussis one and one-half years ago, the mother said it became more markedly enlarged during the spasms of coughing and vomiting; so that she feared at one time that the mass might burst. After the attack of pertussis the mass grew somewhat smaller. The child having become aware of his ability to make this tumor mass appear at will by crying, shouting, singing and laughing boisterously, and having noted his mother's fear on its appearance, would cause the mass to appear whenever the gratification of his slightest wish was denied. His voice had always seemed weak. Nocturnal enuresis was present.

Physical Examination.—A poorly nourished child weighing 44½ pounds (20 kg.) was seen. The child was markedly myopic; both lateral and horizontal nystagmus were present. Inspection of the neck during ordinary respiration revealed no abnormality; the circumference was 26 cm. Hyperextension of the head caused an increase of 1.5 cm. Forced expiration such as counting aloud, laughing boisterously, singing, coughing or closing the mouth and nose and expiring, caused the appearance of a large tumor mass, more marked on the right side than on the left and continuous across the front of the neck,

* Received for publication, Nov. 25, 1924.
* Read before The New York Academy of Medicine, Section on Pediatrics, Oct. 9, 1924.
* The title may be somewhat misleading, but what I wish to bring out is, that this is a congestion of the superficial and perhaps the deeper blood vessels of and about the thyroid gland.

having configuration of the thyroid gland. At that time the enlargement of the mass could be augmented by pressure on the lower portion of the external jugular vein. On swallowing it moved with the thyroid gland. The congestion and consequent enlargement could be prevented from appearing by pressure on the upper portion of the external jugular vein while the child was quiet. The circumference of the neck at that time was 32 cm. Hyperextension of the head increased it to 34 cm. Pressure over the lower portion of the external jugular vein increased it to 36 cm. The tumor mass was tense and dull to percussion. Tracheal breathing and voice was transmitted to the stethoscope. The voice had a characteristic muffling. Roentgen-ray examination of the cervical region failed to reveal the presence of an opening in the trachea, as did the laryngoscopic examination. The child suffered from a traumatic laryngitis following the laryngoscopic examination. During this period, the

Fig. 1.—H. W., showing hyperextension of the head with normal respiration.

mother claimed that the tumor mass appeared more prominent than ever, after forcible acts of expiration. This, no doubt, was due to the added effort necessary for the child to make himself heard and understood during this period.

The remainder of the physical examination was negative. The nocturnal enuresis cleared up under psychic therapy.

Case 2.—J. S., a boy, aged 10 months, was brought to the clinic because of his abnormal development and the incontinence of the urine and feces.

Family History.—Negative. Wassermann test on the patient's mother was negative.

Past History.—The child was born at full term of normal delivery. He was bottle fed, being too weak to take the breast.

Present Illness.—This dates back to the time of birth. At the time of delivery the physician noticed a bulging of the lower portion of the spine, with an absence of the gluteal prominences as formed by the gluteal muscles. There was a continual dribbling of urine and an evacuation of small amounts of yellow, watery fecal material whenever the child coughed. There never

was a normal evacuation of the bowels. The child had a tendency to hold the head in hyperextension. The voice always seemed weak. This fact caused us to inquire as to the presence of a bulging of the neck of the child. The mother replied that she has noticed a symmetrical bulging of the fore part of the child's neck, that only became noticeable on crying, coughing and vomiting. Hyperextension made this bulging still more prominent. Snuffles was present since birth. With the exception of the urinary excoriation of the skin in and about the thighs and buttocks, there was no skin rash.

Physical Examination.—This revealed an emaciated and abnormally developed child, weighing 12 pounds 12 ounces (5,782 gm.), lying with the head hyperextended and crying. The knees were flexed on the abdomen. The skin showed urinary excoriation in and about the thighs and buttocks. There was a generalized enlargement of all the superficial lymph nodes of the body. Snuffles was present. Two lower incisors had erupted. The circumference of

Fig. 2.—H. W., hyperextension of the head and counting aloud shows the bulging mass.

the neck at rest was 20 cm. When crying or coughing, on the fore part of the neck a tense tumor mass appeared, which had the general configuration of the thyroid gland and which became still more pronounced on hyperextension of the head, which posture the child seemed to assume automatically on crying or coughing. At this time the size of the tumor mass could be augmented by pressure on the lower portion of the external jugular veins. The mass moved with the thyroid gland on swallowing. The neck at that time measured 25 cm. in circumference. Pressure over the lower portion of the external jugular veins increased it to 26 cm. The congestion and consequent enlargement could be prevented from appearing by pressure on the upper portion of the external jugular veins while the child was quiet. The mass was dull to percussion; bronchial breathing and voice being transmitted to the stethoscope. The voice had a muffled character. The heart was normal. The lungs showed harsh, almost bronchial breathing over the left upper lobe posteriorly. Vocal resonance was diminished over the entire chest. The abdomen was tense and tympanitic; this making an examination impossible. Decision as to the

palpability of the liver and spleen was impossible. The upper and lower extremities were negative, except for the poor muscular tone which was present over the entire body. The child, though aged 10 months, was unable to sit up. The spine in its lower portion over the sacrum showed a swelling that suggested the presence of a spina bifida occulta. Rectal examination revealed the absence of the coccyx. The buttocks seemed to be entirely absent, due most likely to lack of development of the gluteal muscles.

Roentgen-ray of the lower part of the spine revealed the absence of the coccyx. There was no evidence of a spina bifida occulta.

CASE 3.—H. F., a boy, aged 9 years, was brought because of frequent convulsive seizures.

Family History.—Negative.

Past History.—The patient was the first child, born at term, cesarian section; he was breast fed for six weeks and had bottle feeding thereafter. From the third day until the child was 2 weeks old he had many convulsive seizures. At 3 years he had four attacks of pneumonia in a period of six weeks. At 4 years he had an attack of poliomyelitis, which manifested itself as a right sided hemiplegia and fever. The hemiplegia lasted for twenty-four hours. The fever persisted for ten days. Cataracts of both lenses, for which the child has been operated on on three different occasions, were present since birth.

Present Illness.—This dated back to three days after birth, when the child had a series of convulsions that lasted for two weeks. Since then, convulsive seizures have occurred at varying intervals without any discoverable cause. The voice had always been peculiar. This fact caused us to inquire as to the presence of a bulging of the neck. The mother stated that she had noticed a bulging of the fore part of the neck for a long time. As to the age at which this first appeared, she was not certain. This bulging would become noticeable on crying, coughing, vomiting and loud speaking. This child, the mother says, loved to talk loud and at those times the bulging was especially noticeable.

Physical Examination.—A poorly nourished boy, weighing 50 pounds, very restless and talking quite freely, was seen. His vision was poor because of the presence of cataracts and nystagmus. Inspection of the neck during ordinary respiration did not reveal any abnormality. Forced expiration such as counting aloud, closing the mouth and nose and expiring forcibly, caused the immediate appearance of a large tumor mass which had the configuration of the thyroid gland. Hyperextension increased the size of this tumor mass. At that time pressure over the lower portion of the external jugular veins augmented the size of the mass. On resumption of normal respiration the tumor mass rapidly disappeared. The congestion and consequent enlargement could be prevented from appearing by pressure on the upper portion of the external jugular veins, while the child was quiet. The voice had a characteristic muffling. The remainder of the physical examination was negative.

CASE 4.—J. G., a boy, aged 4 years, was brought to the clinic because of the presence of a transiently appearing tumor on the right side of the neck.

Family History.—Negative.

Past History.—The child was born at term, of normal delivery and was breast fed for one year, with mixed feeding thereafter. He had measles at 2 years and pertussis at 3.

Present Illness.—This dated back to the attack of pertussis at the age of 3 years, when his mother said she noticed for the first time a sudden bulging of the right side of the neck during a spasm of coughing. Thereafter she noticed this tumor mass whenever a spasm of coughing or vomiting occurred. Recognizing his ability to produce this transient enlargement and realizing its value to secure his ends, the child caused the enlargement to appear whenever his slightest wish was denied. The mother was certain that this transient tumor was not present previous to the attack of pertussis.

Physical Examination.—A well nourished boy, weighing 40 pounds (18 kg.) was seen. Examination was negative except for the mass on the neck, which during ordinary respiration showed but slight fulness, a little more on the right side than on the left. On the child's counting aloud, laughing boisterously, singing, and forcibly expiring with the mouth and nose closed, a tense tumor mass in front of the neck was seen to appear immediately, more prominent on the right side. On swallowing, the mass moved with the thyroid gland. The circumference of the neck during ordinary respiration was 24 cm., and during forced expiration was increased to 30 cm. On hyperextension of the head there was an additional increase of 2 cm. of the circumference of the neck. Pressure over the lower portion of the external jugular vein caused an additional increase of 2 cm. The mass rapidly disappeared on resumption of normal respiration. The congestion and consequent enlargement may be prevented from appearing by pressure on the upper portion of the external jugular veins while the child was quiet. The mass was dull to percussion, tracheal breathing and bronchial voice being transmitted to the stethoscope. The voice had a muffled sound.

CASE 5.—E. L., a girl, aged 2 years and 9 months, was brought to the clinic because of the presence of a large, transiently appearing tumor of the right side of the neck.

Family History.—Negative.

Past History.—Negative; the child was born at term, of normal delivery, was breast fed for one year and from then on given mixed feeding. She had never been ill.

Present Illness.—The mother noticed a bulging of the right side of the neck since birth which became especially prominent on crying, coughing or vomiting. This at first was the size of a walnut, but had progressively increased in size with the age of the child. The child, the mother stated, had the habit of lying with her head thrown back (hyperextension) since birth. The mother also said that the child had learned the full value to which she could use this anomaly, by causing the mass to bulge voluntarily when refused the things she wanted. This frightened the mother so that she readily gave in to the child's wishes.

Physical Examination.—This revealed a well nourished child, weighing 35 pounds (15.9 kg.). Examination was negative except for the following: Ordinary respiration showed but a slight fulness of the neck which measured 22 cm. On forced expiration, such as is caused by counting aloud, singing and laughing boisterously, a tense tumor about the size of a small orange was seen to appear, especially on the right side of the neck. This bulging was continuous across the front of the neck, in the episternal notch and to the left side where but slight enlargement was noticeable. It had the general configuration of the thyroid gland. On swallowing, it moved with the thyroid gland. The neck circumference was 27 cm. at this time. Throwing back the head caused the tumor to become more prominent; as did pressure over the lower portion of the external jugular veins. The congestion and consequent enlargement could be prevented from appearing by pressure over the upper portion of the external jugular veins while the child was quiet. The mass was dull to percussion. Bronchial breathing and voice was transmitted to the stethoscope. The voice had a muffled character. The patient was operated on for bilateral inguinal hernia.

Cases 1, 2 and 3 are still under observation. Cases 4 and 5 could not be located at the addresses given.

Of the five children, three were brought to the clinic with the definite complaint of this transiently appearing tumor of the neck. The remaining two patients with this condition were discovered in searching for the

reason for a voice peculiarity, a muffling, that seems to be quite characteristic of this condition. In four of the cases, a transient bulging had been noted since birth. Its origin may have been congenital, in which case the intra-uterine position of the child might have played a part, or the mass might have developed shortly after birth. Four of the patients were males, and one was female. Our youngest patient was seen at 10 months, and our oldest at 9 years of age. Three of these children had recognized their ability to produce this transient enlargement, and realizing its value to secure their ends, caused the enlargement to appear whenever their slightest wish was denied.

This transient congestive enlargement, when unilateral, was more freqently right sided and gave the appearance of an enlarged lobe of the thyroid gland. When bilateral, the right side usually was larger than the left and gave the impression of a bilateral enlargement of the thyroid. In two instances there was a continuous mass across the entire front of the neck, as if both lateral lobes and isthmus were involved. Hence we thought that the title: "Transitory Congestive Thyroid Enlargement" would be most descriptive of this transient tumor.

ETIOLOGY

This condition in mild degree, no doubt, is quite common, but it is rare in the marked degree that was seen in our group of children. The etiology is problematic but the following conditions and diseases definitely seem to have played some part in its production or its further increase in size: 1. Excessive crying in nurslings. 2. Frequent, prolonged or severe attacks of bronchitis. 3. Pertussis. The development of this may be predisposed by diseases that produce a congestion of the vessels of and about the thyroid gland and interfere with the return circulation from the head, but of this there is no definite proof. We would suggest, however, among such conjectured predisposing conditions: 1. Face presentation. 2. Umbilical cord about the neck of the fetus. 3. The almost constant hyperextension of the head during infancy. We may add frequent and sustained crying, shouting and boisterous laughter, because they cause a dilatation of the superficial vessels of the neck and may predispose to the development of this transitory congestive thyroid enlargement.

During normal respiration, there is only slight if any fulness of the front of the neck. On forced expiration, however, such as occurs in crying, shouting, singing, counting aloud, boisterous laughter and by the playing of wind instruments, a tense tumor mass immediately appears. This tumor can be made still more prominent by forced efforts at expiration with the mouth and nose closed, as when lifting heavy weights or straining at stool. Hyperextension of the head during forcible expira-

tion still further accentuates the mass. On resumption of normal respiration the mass rapidly disappears. Its position within the thyroid area easily leads to the erroneous diagnosis of goiter, from which, however, it may readily be differentiated.

The noteworthy characteristic, of the clinical condition under discussion, is the variation in the circumference of the neck before and during the occurrence of the congestion. This transient bulging varies considerably in individual instances; but in one instance was responsible for an increase of 8.5 cm. in the circumference of the neck. (Case 1, H. W., whose photographs are shown.) The enlarged mass is resilient to the touch and cannot be made to disappear by pressure. The congestion and consequent enlargement may be prevented by pressure on the upper portion of the external jugular veins while the child is quiet. The mass can be enlarged by pressing on the lower portion of the external jugular veins, as this dams the venous flow. On swallowing, the mass moves with the thyroid gland. This can be noted only if the act of swallowing occurs immediately after a forcible expiration and before the mass has entirely disappeared. It is dull to percussion; it transmits tracheal breathing and voice. The muffled voice of Case 1, H. W., was changed to aphonia by the traumatic laryngitis that followed the laryngoscopic examination. It is interesting to note that four of our five patients had some other associated congenital anomaly. This is possibly suggestive that the transitory congestive enlargement is likewise of congenital origin.

DIAGNOSIS

In the differential diagnosis of this from other tumors of the neck, one must consider principally four conditions, namely: (1) pneumatocele; (2) emphysema of the tissues of the neck; (3) struma vasculosa, and (4) tracheocele. 1. Pneumatocele is readily ruled out by the following: This tumor mass is not situated in the supraclavicular spaces; it is dull to percussion, bronchial breathing and voice are transmitted to the stethoscope, and in two instances the tumor was continuous across the front of the neck. 2. Emphysema of the tissues of the neck is negated because of the absence of a history of trauma, the absence of emphysematous crackling on palpation, the localization of this tumor mass, as well as because of the dulness on percussion and the transmitted breath sounds. 3. Struma vasculosa is excluded by the transitory character of the mass. It is quite possible that a frequent and continuous repetition of any or all of the before-mentioned acts of forced expiration, if continued for a long period of time, may cause this transitory congestive thyroid enlargement to become the permanent struma vasculosa. 4. Differentiation from tracheocele is difficult. Tracheocele is defined as an air containing tumor situated in the front of the neck, some-

times unilateral, sometimes bilateral, communicating with the interior of the trachea by a small opening. It also is a transiently appearing tumor mass of the neck, situated in the region of the thyroid gland. During ordinary respiration there may be a slight fulness in front of the neck; but on forced expiration, a tense tumor becomes apparent.

REVIEW OF THE LITERATURE

Tracheocele was known to the earlier writers but one finds no mention of it in the literature of today. Cases have been described by Ammon,[1] Behr,[2] Rokitansky,[3] Lizé,[4] Gayet,[5] Leriche,[6] Förster,[7] Guyon,[8] Devalz,[9] Faucon,[10] Fischer,[11] and Eldridge [12] of Yokohoma. Eldridge, in addition to publishing a case occurring in his own practice, has collected nearly all the recorded examples of the disease and has written an article on the subject. Eldridge, Cohen [13] and Morell Mackenzie [14] are the only ones who have written on the subject in detail in English.

The origin of tracheocele is quite obscure. It is quite possible that it is due to various causes. There can be no doubt that in rare cases it arises as a development defect, either from defective closure of one of the bronchial clefts, or merely from a feeble development of one of the intercartilaginous spaces of the trachea. Tracheocele or tracheal hernia, with two exceptions, has always been reported as occurring in adults. In the two exceptions it had existed since birth and in one of these, that of von Gohl, described by Ammon,[1] it was associated with an irregular development of the thyroid gland. Referring to this malformation Ammon says:

> There exists a single and very incompletely described case of congenital bronchocele reported by Gohl; in this instance there was a complication with struma. The increase of the tumor on inspiration and crying as well as the unaltered condition of the tumor on expiration without crying, showed the existence of the complication with bronchocele.

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1. Ammon: Die angebornenen chirurgischen Krankheiten des Menschen, Berlin, 1842, p. 54.
2. Behr: Gaseous Thyroid Tumors, Wchnschr. f. d. ges. Heilk. Berlin, 1836, p. 361-368.
3. Rokitansky: Oest Jahrbuch. **16**:3, 1845.
4. Lizé: Emphysematous Goitre, Bull. Soc. Chir. de Paris, Series 2, **1**:529, 1861.
5. Gayet: Compt. rend. Soc. d. Sc. med. de Lyons, 1865-1866, p. 5.
6. Leriche: Mem. Soc. d. Sc. med. de Lyons, **7**:381-384, 1868.
7. Förster: Handb. d. spec. path. Anat. **2**:309-314, 1863.
8. Guyon: Gazette Heb. (June 24) 1873.
9. Devalz: Gazette des Hop. (Nov. 8) 1873.
10. Faucon: Arch. Med. Belgas. (Jan.) 1874.
11. Fischer: Pitha and Billroth's Handbuch, **3**, part 1, Number 3.
12. Eldridge: Am. J. M. Sc. (July) 1879.
13. Cohen: Ashurst's Encyclopedia **5**:660-662, 1884.
14. Mackenzie, Morell: Diseases of Throat and Nose, **1**:537, 1880.

Riegal,[15] discussing congenital fistula of the neck, cites a case which although the report is incomplete appears to us to have been similar to that quoted by Ammon.

A child, 12 years old, when in the fifth year of its age, had a tumor form 2 inches above the manubrium sterni, and about in the middle line between both sternal portions of the sternocleidomastoid muscle. The tumor had been opened by means of some caustic, which left a small ulcer and a fistula. The probe penetrated about an inch and a quarter upward and gave exit to a stringy, tenacious mass, which contained mucous corpuscles. The first impression was that this was a case of congenital fistula of the neck; a diagnosis, however, which was excluded by inquiry into the history of the case. Apparently a lymphatic gland had undergone suppuration, and the abscess formed had descended and ruptured lower down. The tract was cut open. It appeared clothed with epithelium, and could be followed as far as the level of the thyrohyoid ligament. It was excised, together with the cicatrix of the ulcer. During the union of the wound air bubbles escaped repeatedly indicating, therefore, a communication with the air passage, so that the case was explained as one of congenital fistula of the neck.

It is an important fact that this form of pseudo goiter is generally produced under the influence of repeated and sustained bodily exertions. Heavy occupations and singing predispose persons to the condition. It was seen in Egypt amongst the blind, who are employed to chant verses of the Koran from the minarets at all hours of the day and night, for the purpose of marking the time and calling the attention of the faithful to their duties. The tumors appear only at the time that they commence to chant their exercises, and the sufferers are compelled to compress them. When the internal openings are much dilated, so that aerial tumors of the size of a fist are instantly produced by the expiratory effort, these persons are permitted to retreat into the privacy of the temples.

In some cases it appears to originate during the act of vomiting, violent coughing or during the severe straining of labor. External pressure when applied, at times may prevent the tumor from appearing; if one is fortunate enough to press on the tracheal opening. More often this is impossible, as the opening in the trachea is likely to be situated on its posterior aspect. On percussion, tympany or dulness is noted, and a distinct impulse is conveyed to the hand on coughing. Bronchial breathing and voice is heard with the stethoscope. Tracheocele does not present the muffled voice, which is so characteristic in our cases of transitory congestive thyroid enlargement. Roentgen-ray examination may or may not show the opening in the trachea. Laryngoscopy may reveal the tracheal defect unless it is obscured by a tracheal fold of mucous membrane. Needle puncture may be used as the best and only means of differentiation between the two conditions. In Eldridge's case,

15. Riegal: Zienssin's Cyclopaedia, American Edition, **4**:289, 1877. This case is also described by Fischer.

on puncturing the tumor with a needle a stream of air forcible enough to extinguish a lighted match was emitted. Klaussner,[16] in attempting to use this method of diagnosing a supposed tracheocele from an enlarged and congested thyroid, obtained blood and was therefore loath to call his case a tracheocele. He believes, as we do with Burchardt, that a correct diagnosis can only be made by an anatomic dissection at the time of operation or at a necropsy of the affected part.

The definite pathology of transitory congestive thyroid enlargement is unknown, as no necropsies have been available thus far.

COMMENT

The prognosis in transitory congestive thyroid enlargement does not seem to be unfavorable to life. It is important, however, to regulate the life of the child so that as little strain as possible is placed on the affected tissues. This can be done by cautioning the child not to shout, sing, count aloud, laugh boisterously, lift heavy weights or strain at stool, and especially to refrain from any act that necessitates hyperextension of the head. The mother should be cautioned against allowing the child to learn to play any wind instruments, if the child is musically inclined. Every means should be adopted to lessen the likelihood of the cervical tissues becoming congested. If it has originated as a congenital deficiency, cure is improbable; if however it has arisen as a result of violent exertion, it may possibly be cured or disappear spontaneously providing the causal strain can be eliminated. If the cause is not removed and the continuous congestion of the vessels continues there is great possibility of the enlargement becoming permanent.

The proper treatment is still problematic. It may consist of some mechanical appliance for preventing the distention and progressive development of the tumor.

9 West 117th Street.

16. Klaussner, F.: Ueber Tracheocele und Blahrkropp, Munchen. med. Wchnschr. **42**:997 (Oct. 22) 1895.

A CASE OF SCAPHOCEPHALY WITH MALFORMATIONS OF THE SKELETON AND OTHER TISSUES *

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BOSTON

The case of M. F. here reported presents an extremely unusual association of skeletal anomalies with certain other developmental abnormalities.

REPORT OF CASE

Family History.—The father and mother of the child were living and well. The father was a rather short, stocky man, the mother was somewhat taller. Roentgen-ray pictures of the father's extremities were normal. Three other children and both parents showed no evidence of the condition exhibited by this patient. There was no history of tuberculosis, insanity or syphilis in the family.

M. F., a girl, was born at full term, of normal delivery, the birth weight being 10 pounds (4.5 kg.). The patient was the smallest of all the children at birth. During the first three months of life she cried a good deal, but was always strong and vigorous and nursed well.

Past History.—The patient was breast fed for eleven months, and was fed at irregular intervals, whenever hungry or crying. Fruit juices, but no solid food, had been added some time before weaning. The patient was "weaned in one day" and put on bread, milk, vegetables, etc. Later meat and sweets were given. The child seemed hungry most of the time.

The patient sat up at about the age of 9 months. She cut six teeth, all at one time at from 9 to 10 months; none had come through since. She walked at 15 months. So far, she could only say "Mama" and "Daddy."

The child had no regular hours. She usually was put to bed at 8 p. m. and waked at 7 a. m., but often cried during the night unless fed again. No coffee or tea was given her, but considerable amounts of cake and candy.

The patient had always been well except for frequent head colds. The adenoids were removed at 6 months because of difficulty in breathing.

Present Illness.—The baby was admitted because of discharge from the left ear, and also because the mother thought that the patient had not been developing normally for the last six months. It was thought that she had rickets because of the wide open fontanel, and cod liver oil, one teaspoonful three times daily, had been given. Until recently the patient perspired a great deal. One week before admission she became very irritable and it was noticed that the left ear was discharging. There was no vomiting, the bowels were regular and the appetite good.

Physical Examination.—In general appearance the patient was a short, fat, thick-set girl, aged 17 months, whose peculiar facies, oddly shaped head and short, thick arms were noticeable at a glance. She could walk, but when left alone sat down, displayed very little interest in her surroundings, was strikingly inactive and soon lay down and fell asleep. When played with she responded with a smile, said "da" in a pleased and entirely normal tone of voice, investigated the object offered and for the time being looked

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* From the Children's Hospital and the Department of Pediatrics, Harvard Medical School.

fairly alert and capable. The slightest attempt at a physical examination was responded to by loud crying and an attempt to push the examiner away.

In the sitting position she presented a striking kyphosis of the lower thoracic and upper lumbar region, which persisted to a slighter extent when she stood. The flaring costal margin and pot belly suggested rickets.

The glands were just palpable in the neck and axillae.

The skin everywhere was soft, smooth and of the usual moisture. No sweating was observed.

In parts there was a redundancy of skin and flabby subcutaneous tissue. This was most striking over the inner and upper portions of the thighs where the atonic superficial tissues lay in folds. The backs of the hands, the anterior axillary regions and the neck showed a less marked degree of "cutis laxa."

Over the shoulders, upper back and upper arms was a soft light brown lanugo. Similarly over the upper lip there was a growth of soft, fine hair exceeding the usual amount. The eyelashes were long and black; the eyebrows were dark and rather heavy, the hair extending to the bridge of the nose in the midline.

The hair of the head was light brown, medium weight, and very soft and silky. The scalp was slightly scaly over the occiput.

The muscles everywhere were flabby and poorly developed. There were, however, no herniae and no weakness of any one muscle group except the external rectus of the left eye.

The head was scaphocephalic in type, about normal in width and height but conspicuously long owing chiefly to the prominent forehead. Measurements showed that the circumference (50 cm.) and the length (17.5 cm.) actually showed greater values than the average for this age.

Palpation of the vault revealed an open anterior fontanel, 4 by 4 cm., lying in a vertical plane with the external auditory meatus. Its bony margins felt thickened. Relative to the margins, the fontanel was somewhat depressed. It felt firm, possibly slightly cartilaginous, but transmitted pulsation. The posterior fontanel was closed. The metopic, coronal and lambdoidal sutures were just palpable. The sagittal suture was remarkable only in its posterior 5 cm., where it was felt as a low rounded ridge 1 cm. broad. There was nowhere any suggestion of the concave crista sagittalis so often associated with scaphocephaly. The prominent overhanging forehead started to bulge forward immediately above the supraciliary grooves. It was rounded like one continuous boss, slightly more prominent in the central vertical zone 2 cm. wider than elsewhere. This central zone was demarcated on either side by a narrow groove in which lay a superficial vein, easily but not strikingly visible. The parietal bosses were well marked just behind the plane of the ears. The occiput, rather flat in its upper half, presented a marked rounded prominence low down.

The face proper was infantile in type and underdeveloped in comparison with the vault. With the forehead it was concave in profile, the orbits and bridge of the nose appearing greatly depressed in relation to the prominent forehead and heavy, wide jaw and cheeks. The ears were placed very low, the highest point being 1 cm. below the external canthus of the eye, the lowest 5 mm. above the angle of the superior maxilla. The tragus lay on a plane midway between the nose and mouth.

The eyes had nearly a horizontal axis, with the external canthus slightly above the internal. The lid slits were rather narrow, the eyes deepset. There was a marked internal strabismus on the left and a question of lateral nystagmus on fixation. The pupils reacted to light and in accommodation. Of particular interest was the slight diffuse clouding of both corneae. Dr. Goodall gave us the following opinion regarding the eyes:

"There are absolutely no external signs of inflammation. The conjunctivae are clear. All that can be seen is a slight haze in the external layer of the

corneae. The haze is so diffuse that the fundi cannot be seen. This is probably a congenital condition."

The nose was short and broad. The cheeks were very full and flabby. The jaw appeared unusually broad and heavy.

The palate looked normal in height but strikingly narrow and short, apparently because the space which it usually occupied was encroached on anteriorly and on both sides by the exceedingly broad alveolar process. This process formed nearly a straight line anteriorly instead of the usual rounded arch.

The teeth numbered only six in all, four upper incisors and two lower central incisors, and were separated by gaps.

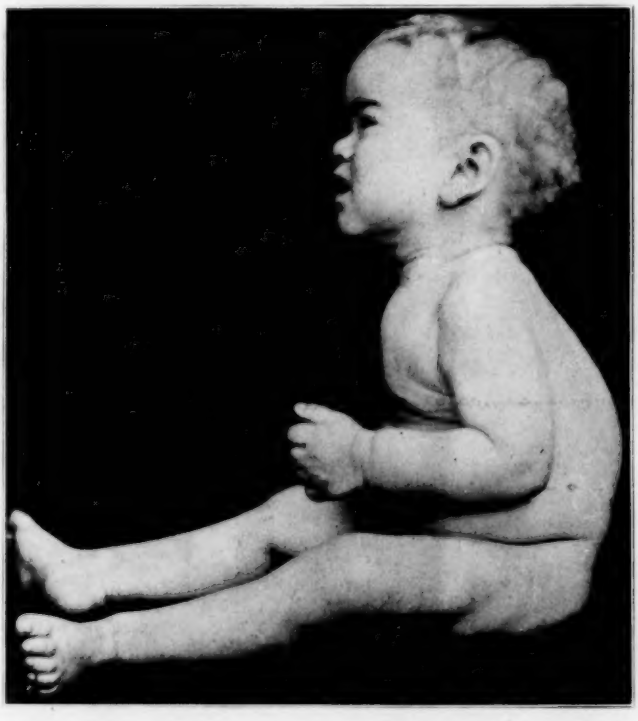

Fig. 1.—When sitting the spine showed a dorsolumbar kyphosis.

The tongue was broad and thick with rather prominent papillae.

The neck was very short with folds of loose skin. The lymph glands were just palpable, the thyroid gland was not felt.

The rib cage of the chest was short with slight beading of the costochondral junction, Harrison's groove and flaring costal margin. The clavicles were short and thick, the sternum prominent in the upper half, depressed in the lower.

The heart and lungs were negative to percussion and auscultation.

The spine showed a dorsolumbar kyphosis which was very pronounced when the patient sat up, and lessened but by no means disappeared when she stood. There was no scoliosis.

The scapulae, which appeared rather small and far apart, rotated strikingly as the arms were elevated, so that the outer borders and angles protruded several centimeters on each side of the body (Fig. 2).

The arms were very short and thick, the tips of the fingers reaching only to the external trochanter when the patient stood. Passive extension at the elbow was incomplete and associated with a valgus position. Passive movements at the shoulder joint were also somewhat limited, especially internal and external rotation and elevation. There were no paralyses.

The epiphyses did not feel relatively enlarged.

The hands were short, thick and plump and were habitually in a semiflexed position. When the hands were extended, loose tissue was piled in high folds over the backs. Full extension of the fingers never occurred actively but could be passively accomplished without difficulty.

The little fingers had a moderate lateral curvature with the concavity to the radial side. The finger nails were smooth and unusually curved from end to end.

Fig. 2.—The limited movements of the shoulder joint.

The abdomen was soft and bulging but showed no herniae. The edge of the spleen was easily palpable just below the left costal margin. The liver was greatly enlarged, extending 7 cm. below the xyphoid process and 5 cm. below the costal margin in the midaxillary line.

The legs did not show the shortening seen in the upper extremities. They were remarkable only for a slight genu valgum and for the large folds of tissue over the inner aspects of the thighs.

The genitalia were normal.

The measurements of the head in centimeters were as follows: Greatest length (fronto-occipital), 17.5; greatest breadth (biparietal), 13.1; bitemporal diameter, 12.9; nasion-inion, 16.3; biauricular (tragus-tragus), 10.8; horizontal circumference (fronto-occipital), 49.5; sagittal arc (nasion-inion over vertex), 33.0; transverse arc (tragus-tragus), 31.7; bizygomatic breadth, 10.0; interocular breadth, 2.8; external biorbital breadth, 8.2; chin vertex, 17.5 ; total face height (chin-nasion), 7.2; upper face height (alveolar-nasion), 4.0; nasal height, 2.4; nasal breadth, 2.6.

The body measurements were: Total length, 81.0 cm.; suprasternal notch to top of pubis, 29.2 cm.; chest, 48.0 cm.

The arms measured: Acromion to end of radius, 21.6 cm.; end of radius to tip of second finger, 8.0 cm.; total length of arm, 29.6 cm.

The legs measured: Top of pubis to lower edge of patella, 21.2 cm.; lower edge of patella to sole, 20.0 cm.; total length of leg, 41.2 cm.

Clinical Course.—Both eardrums were incised after admission and the upper respiratory infection cleared up within a week. The lungs were not involved.

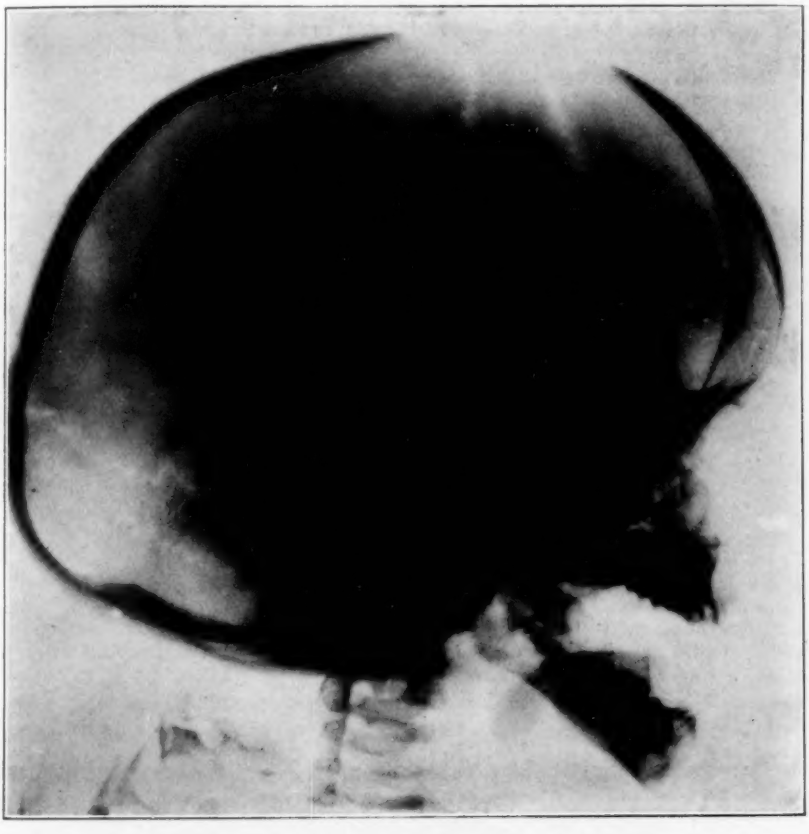

Fig. 3.—Roentgenogram of the skull.

Shortly after admission the effect of thyroid extract was tried in order to rule out a possible atypical form of cretinism. The patient was started on one-half grain per day and the dose gradually increased to one-half grain three times daily. No improvement was observed during a period of two weeks, which was marked by rapid loss in weight and frequent vomiting. Reduction of the thyroid extract to one-half grain daily did not result in relief from these symptoms. The vomiting stopped and the baby began to gain in weight only when the administration of thyroid was entirely discontinued.

The appearance of the patient and her mentality showed no change during a stay of almost six weeks.

Laboratory Findings.—These were essentially negative.

The red blood count was 5,200,000; the hemoglobin 85 per cent. (Sahli—corrected for age). No abnormal forms, achromia or stippling.

Platelets, not counted, appeared normal in smear.

Leukocytes, 9.400 per cubic centimeter; differential count: 42 per cent. polymorphonuclears; 47 per cent. lymphocytes; 10 per cent. transitionals, and 1 per cent. eosinophils. During a slight upper respiratory infection the white count rose to 17,400 with 52 per cent. polymorphonuclears, 42 per cent. lymphocytes and 6 per cent. transitionals.

The intradermal test for tuberculosis (0.2 c.c. of 1:1,000) was negative.

The Wassermann blood test was negative on two examinations.

Blood calcium, 9.4 mg. per hundred cubic centimeters.

Blood phosphorus, 4.25 mg. per hundred cubic centimeters.

The urine was found to be negative on repeated examinations.

Roentgen-Ray Report.—(Dr. M. C. Sosman): "Films of the bones show them to be rather uniformly denser than normal, with a heavy squared appearance particularly in the long bones. The small bones of the hands and feet

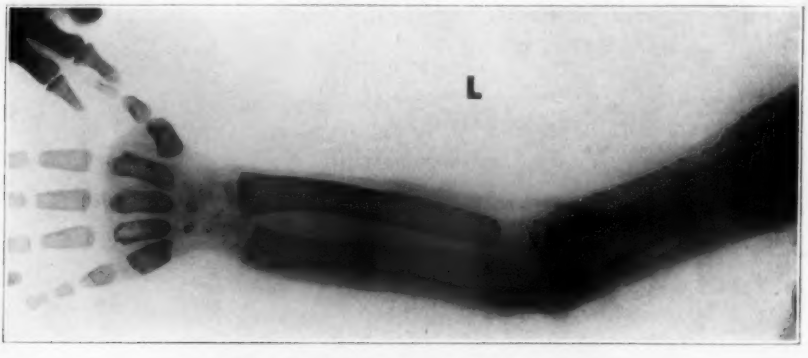

Fig. 4.—Roentgenogram of arm.

show heavy, coarse trabeculations but no apparent interference with epiphyseal development. The skull appears rather large and shows aberrant vessels in each frontal area. The sutures appear slightly widened."

COMMENT

This patient undoubtedly falls into that large, ill-defined group of cases with congenital and hereditary malformations, which are confined almost exclusively to the osseous system and to the membranous rather than the cartilaginous bones. She presents, however, certain striking departures from any one of the recognized clinical groups such as "Dysostosis Cleidocranialis Hereditaria" so named by Scheuthauer [1] in 1871, and first accurately described by Marie and Sainton [2] in 1898, "Dysostosis Cranio-facialis Hereditaria" of Crouzon,[3] "Dystrophia Periostalis Hyperplastica" of Dzierzynsky,[4] or any of the more common

1. Scheuthauer: Allg. Wien. med. Ztg. **16**:293, 1871.
2. Marie and Sainton: Rev. Neurol. **6**:835, 1898.
3. Crouzon: Presse méd. **20**:737, 1912.
4. Dzierzynsky, W.: Ztschr. f. Neurol. **20**:547. 1913.

head deformities (acrocephaly, scaphocephaly, etc.) with or without syndactilism.

We have found only two cases in the literature which closely resemble this patient. These were children in Pfaundler's Clinic described by Hurler [5] and later presented at the Münchner Gesellschaft by Pfaundler.[6] They were then 5 years old and had been followed since the age of 2 years. To review these cases would be to repeat in almost every detail the account we have just given our case. In several manifestations such as corneal clouding, hypertrichosis, flexion contractures of the fingers, these three cases are unique among the "dysostoses." In other respects they correspond fairly closely to certain aspects of the clinical picture in several other groups. The short heavy bones, for instance, are characteristic of Dzierzynsky's group, but his cases were also familial and hereditary, showed premature closure of the fontanels and sutures and a thickened cranial vault, features not present in our case.

Patients with "Hereditary Cleidocranialis" as described by Marie and Sainton resemble our patient in the contour of the face, the delayed closure of the fontanels and delayed dentition, but differ in two of the three characteristics which gave that disease its name, i. e., the hereditary factor and the incomplete or defective development of the clavicles.

Crouzon's cases differ from our case chiefly in the malformation of the face, particularly the prognathism of the lower jaw, the congenital exophthalmus and divergent strabismus, and the familial and hereditary character.

Aside from these fairly well defined clinical entities are the numerous persons with such cranial malformations as oxycephaly and scaphocephaly, who usually come to the physician for relief of the symptoms produced by increased intracranial pressure, a disturbance of vision, headaches, sometimes vomiting and convulsions. Those instances in which malformations of the extremities were associated with acrocephaly and scaphocephaly were collected by Park and Powers [7] in 1920. These authors give a most comprehensive review of the subject with a full discussion of the etiology of these deformities. They conclude that the defects are either germinal in origin or acquired in the preblastemal period of fetal life, probably the former.

One other case reported by Berkhan [8] in 1907 should be mentioned. The description of this boy, aged 3½ years, conforms fairly closely to

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5. Hurler, G.: Ztschr. f. Kinder. **24**:220, 1919.

6. Pfaundler: Jahrb. f. Kinderh. **92**:420, 1920; Handbuch der Kinderh. Ed. 3, **1**:960, 1923.

7. Park, E. A., and Powers, G. F.: Acrocephaly and Scaphocephaly with Symmetrically Distributed Malformations of the Extremities, Am. J. Dis. Child. **20**:235 (Oct.) 1920.

8. Berkhan, O.: Arch. f. Antrop. n. F. **6**:8, 1907.

that of our patient, except for the absence of corneal clouding and hypertrichosis. His photograph shows a striking resemblance to one of Hurler's cases and to ours.

SUMMARY

Summarizing the chief characteristics of Hurler's two cases and our one, which, taken together form a picture differing from any one of the before mentioned clinical groups, we have the following:

1. Negative family history.

2. History of the development in the latter half of the first year of a pronounced kyphosis, delayed dentition, a general apathy, which in Hurler's cases amounted to a true mental retardation after the age of 2 years.

3. Physical examination shows in addition: short heavy bodies; heads of abnormal shapes, one oxycephalic, two scaphocephalic, with open fontanels. No evidence of increased intracranial pressure. Infantile type of face with heavy jaw and broad alveolar process. Marked dorsolumbar kyphosis. Short heavy bones, especially arm bones and clavicles. Limitation of movement at elbow and shoulder. Short pudgy hands with incompletely extended fingers. Pot belly (with herniae in Hurler's cases). Redundancy of superficial tissues. Hypertrichosis. Corneal clouding.

CONGENITAL ELEPHANTIASIS*

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The following patients, Cases 1 and 2, came under observation in the the pediatric and orthopedic departments of the Allegheny General Hospital.

REPORT OF CASES

CASE 1.—F. C., a boy, aged 6 years, of Italian parentage was born in western Pennsylvania. He was one of thirteen children. There were seven brothers and four sisters living who were in good health. Two brothers died in infancy from unknown causes. There was no family history of tuberculosis, syphilis or alcoholism. The previous history of the patient was good. He had had no infectious diseases. At birth there was a marked swelling of the right leg. He had had attacks of high fever, coming on suddenly and lasting about eight or ten days, accompanied by convulsions, vomiting and severe pains in the right lower extremity. These attacks came periodically at intervals of about six or seven months, the last one occurring about three or four days previous to admission to the hospital. We were fortunate enough to observe him in one of these attacks while he was still in the hospital.

On the thirtieth day after operation, he suddenly became acutely ill with vomiting, high temperature and extreme prostration. He complained of severe pains in the right inguinal region and right leg, which became very swollen. There was some inguinal adenitis. A peculiar erythema closely resembling erysipelas appeared on the affected leg, but did not involve the wound. It spread up the thigh to the buttocks. Examination of the heart, lungs and abdomen was negative. The leukocyte count was 13,400; blood culture negative. A blood culture taken from the wound showed *Streptococcus infrequens.* The eruption disappeared on the third or fourth day, and all the acute symptoms subsided after the tenth day.

On admission to the hospital the following features were noticed. The patient was fairly well nourished, slightly anemic, and the expression of the face was somewhat sad. The most striking feature was the enlargement of the lower extremity. The foot was very swollen. There was a pad-like tumor on the dorsum of the foot, which, however, was not painful and did not pit on pressure. The skin was not reddened. The tips of the toes could just be seen and the appearance of the foot closely resembled that of an elephant, which Figures 1 shows. The swelling extended up to the thigh; the right arm also was affected. There was some thickening of the prepuce. Numerous laboratory examinations for some specific micro-organism were entirely without results. Roentgen-ray examination showed no involvement of the bones.

The patient was transferred to the orthopedic department, and the Kondoleon operation was performed by one of us (Y.).

From the surgical point of view, this case is interesting, because of the rarity of the condition and the consequent lack of experience in surgical treatment of children. We have been able to find but one case reported in which operative treatment had been tried on a child (Castellani[1]), a boy, aged 10 years.

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* Received for publication, Nov. 10, 1924.

1. Castellani, Aldo: Palliative Treatment of Elephantiasis. Brit. M. J. **2**:1361, 1908.

The original operative procedure proposed by Kondoleon seems to alleviate the condition in two ways, first by the actual removal of redundant tissue, and by establishing partially adequate connection between the superficial and deep lymphatics. Various modifications of the Kondoleon operation have been proposed and practiced by Lanz,[2] Oppel,[3] Rosanow,[4] Matas,[5] and Sistrunk,[6] but it seems that the principle of treatment is essentially the same.

When first seen the circumferential measurements were as follows:

	Right Inches	Left Inches	Right Cm.	Left Cm.
Foot, mid-metatarsal	11½	8¾	29	22
Ankle	9½	8½	24	21.75
Calf, 3 inches below knee	11	10	28	25.50
Knee	9¾	9¾	24.75	24.75
2 inches above knee	11	9¼	28	23.50

Operation.—Under ether anesthesia and with a tourniquet applied to the thigh, a section of skin and subcutaneous tissue including the deep fascia were excised. The incision began just below the knee and extended to the maleolus. The portion removed was 3 cm. wide at the center and tapered off to a point at the extremities of the incision. After having excised this portion of the subcutaneous tissue underlying the skin, the edges were undercut on each side and strips approximately 2 cm. wide were excised. This was done on both the outer and inner surfaces of the leg. A section was then removed in a similar manner from the dorsum of the foot. The excised portion was 5.5 cm. wide, and the undercutting excision was extensive enough to remove practically all of the subcutaneous tissue on the dorsum of the foot. The total weight of all tissue excised was 310 gm.

The pathologic report on the excised tissue was as follows:

The specimen consisted of three large masses of fat and two smaller ones. The entire material weighed 310 gm. The larger masses each showed an elliptical area of skin measuring 10 by 2 cm. The fatty tissue was made up of, for the greater part, small pale lobules of fat. However, one of the larger masses had a distinctly different appearance from the others. The overlying skin and subcutaneous tissue in this mass were almost of the same pale, faintly yellow color. The subcutaneous tissue did not have the appearance of fat, but rather that of fibrous tissue with some fat in it. It was more dense than fat and wetter on cross sections.

Sections showed an extensive fibrosis replacing subcutaneous adipose tissue. Throughout these sections there was a mononuclear perivascular exudate in the affected fatty tissue, with occasional lymphoid follicles. Here and there were large lymphatics filled with a mass of endothelial leukocytes. There was no indication as to the nature of the chronic inflammatory process.

2. Lanz: Eroffung Neurer Abfuhrwege bei Stauung in Bauch und Unteren Extremitaten, Zentralbl. f. Chir. **38**:3-5, 1911.

3. Oppel: Conservative Treatment of Elephantiasis, Khirurg. Arkh. Velyaminova, S. Peterb. **27**:387-394, 1911.

4. Rosanow, W. M.: Lymphangioplastik bei Elephantiasis, Arch. f. klin. Chir. **99**:645-655, 1912.

5. Matas, R.: Surgical Treatment of Elephantiasis and Elephantoid States Dependent Upon Chronic Obstruction of the Lymphatic and Venous Channels, Am. J. Trop. Dis. **1**:60-85, 1913.

6. Sistrunk, W. E.: Collected Papers, Mayo Clinic **10**:983-996, 1918; Elephantiasis Treated by Kondoleon Operation, Surg., Gynec & Obst. **26**: 388-393, 1918.

After a preliminary period (three weeks) of recumbency and elevation of the limb, the following measurements were recorded:

	Inches	Cm.
Foot, midmetatarsal	11½	29.3
Ankle	9¼	23.4
Calf, 3 inches below knee	9	23.0
Knee	9¾	24.0
2 inches above knee	11	28.0

The immediate postoperative course was uneventful. The wounds healed by primary union, except for slight sloughing of the skin edges on the dorsum of the foot. The granulating area resulting from this was later closed successfully by a minor plastic operation. Measurements taken one month after operation were as follows:

	Inches	Cm.
Foot, midmetatarsal	8¾	27.0
Ankle	8½	21.4
Calf 3 inches below knee	9	23.0
Knee	9¾	24.0
2 inches above knee	9⅝	25.0

Results.—We have had an opportunity to observe the patient once since his discharge from the hospital. The measurements remained approximately the same as those taken on discharge. He is able to wear an ordinary shoe. The subcutaneous hyperplasia in other parts has increased slightly, and he has suffered two acute febrile attacks similar to those recorded in the first part of this paper. It is interesting to note that in each of these attacks there was no local manifestation in the operated extremity.

Case 2.—J. S., a girl, aged 6 weeks, was of American parentage and the third child in the family. There was no family history of congenital malformations on either side. Nothing unusual occurred during pregnancy and the birth was normal. At birth the left limb was noticed to have the abnormal development as seen in Figure 3. The affected limb appeared to be two or three times larger than its fellow. Unfortunately, no measurements were made at the time of birth. The mother, however, insisted that the leg became reduced in size.

When this patient came under our observation she was aged 6 weeks, and presented the following features: With the exception of the left lower extremity the patient was perfectly normal in appearance and development. The left foot was grotesque in appearance, the big toe being enormously enlarged with inflammation around the nail. The fourth and fifth toes were webbed. The induration involved the entire limb. The skin was hard, did not pit on pressure and was not discolored.

The following were the measurements at the age of 8 weeks:

	Right		Left	
	Inches	Cm.	Inches	Cm.
Length of limb	9	22.50	10½	27.0
Thigh circumference	5⅛	13.0	6⅞	17.50
Knee	5	12.50	6	15.0
Leg	4⅛	10.50	5½	14.0
Circumference over dorsum of foot	3½	9.0	6⅜	16.0
Length of foot	3¼	8.0	5	12.50
Width of anterior arch	1⅛	3.0	2½	6.50

Figure 1

Figure 2

Fig. 1.—Congenital elephantiasis.

Fig. 2 (Case 1).—Congenital elephantiasis, after operation.

Laboratory Report.—Smear from exudate from great toe showed myriads of gram-positive cocci occurring singly, in pairs and in chains. The peculiar feature of the exudate is that there seemed to be an absence of pus cells. Attempts to isolate a specific organism failed, owing to the rapid growth of the *Bacillus proteus.* A staphylococcus and streptococcus were found.

This patient is still under observation, and is gradually improving by the continuous application of a pressure bandage.

Fig. 3 (Case 2).—Congenital elephantiasis.

Two cases were reported in 1898 by Dr. John H. Jopson [7] of Philadelphia, and occurred in the same family. The first patient was aged 4 years, and the second aged 1½ years. The father suffered from a

7. Jopson, John H.: Two Cases of Congenital Elephantiasis, Arch. Pediat. **15**:173-178, 1898.

similar condition in childhood, which gradually disappeared as he grew older. The elder of the two patients manifested the following features from birth:

Marked swelling of both lower extremities, involving the feet and legs almost as high as the knees, the increase in size being especially

Fig. 4.—Congenital elephantiasis. Dr. Jopson's case, 1898.

due to a thickening or infiltration of the skin and subcutaneous tissues. The swelling seemed firm, but pitted on prolonged pressure and resembled edema. It formed thick pads over the dorsal surfaces of the feet and did not appear to be associated with any hypertrophy of the

underlying bones. The skin was white, turning to bluish-red on exposure, was somewhat thickened but of normal temperature. The prepuce was long, thickened and chronically inflamed.

The younger child at the time of observation was aged 1½ years. The condition here, too, was congenital and similar in appearance to the older child but less marked. The feet were not so large and the swelling extended only slightly above the ankles. The prepuce was not affected.

Aside from the conditions described, both children were perfectly healthy mentally and physically. Examining physicians did not believe that they belonged to the angioneurotic type of disease, described by Milroy.

Owing to the extreme rarity of congenital elephantiasis, the literature regarding the condition is very meager. Ritter von Reuss [8] in his textbook gives some interesting data regarding this condition, which we quote:

> The term embraces many congenital changes varying their anatomy and etiology, the common factor in them all being a diffuse thickening of the soft parts in certain portions of the body, more especially the lower limbs.
>
> It is is necessary to distinguish telangiectatic elephantiasis from the lymphangiectatic form, these conditions being due to abnormalities in the vascular or lymphatic system (cystic dilatation, etc.). Some forms of elephantiasis are probably caused by the congestion which follows intra-uterine constrictions by amniotic bands, and in these cases transverse furrows mark off the elephantiasis portions from the healthy parts. Some authors (Nelsen, Bernhard and Blumenthal) think these furrows are caused by thick fibers binding the subcutaneous tissue down to deeper parts of those fibers running transversely at the border of the joint.
>
> In other cases, there appears to be a simple hyperplasia of the connective tissue, due to some morbid predisposition or inherent tissue defect (Noggerath). This view is strengthened by the occurrence of elephantiasis in families and by its association with other malformations in the same infant (Nonne). The forms of diffuse simple elephantiasis which manifest themselves as a cushion-like bulging of the affected soft parts depend on a predisposition to the new formation of connective tissue, which also leads to the development of circumscribed forms of lobular elephantiasis and fibromatosis multiplex, etc. (Spictschka, Manizer, Helburg, Behan). The skeleton may also be involved in elephantiasis (Rach).
>
> The prognosis is unfavorable so far as recovery goes, because the condition is really a malformation; but the general health of the infant does not suffer. The affected parts have a tendency to erysipelatous inflammation and this may be a source of danger (Virchow).

The etiology of congenital elephantiasis is very obscure. The occurrence of streptococci in Cases 1 and 2 is very significant in view of the following excerpt from "Plastic Surgery," Davis.[9]

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8. Von Reuss, August Ritter: Diseases of the Newborn, New York, William Wood & Company, 1921, pp. 417-418.

9. Davis, John Staige: Plastic Surgery, Its Principles and Practice, Philadelphia, P. Blakiston's Son & Company, 1919.

In the United States this condition is seldom met with as a result of obstruction of the lymph vessels by the filaria bancrofti. Matas believes that venous or lymphatic stasis followed by bacterial invasion, usually streptococcic, is necessary to produce true elephantiasis, and gives the following conditions as essential in producing the picture: (1) A mechanical obstruction or blockage of the veins and lymphatics of the region, usually an obliterative thrombophlebitis, lymphangitis or adenitis; (2) hyperplasia of the collagenous connective tissue of the hypoderm; (3) gradual disappearance of the elastic fibers of the skin; (4) the existence of a coagulating dropsy or hard lymphedema; (5) a chronic reticular lymphangitis caused by secondary and repeated invasions of pathogenic micro-organisms of the streptococcal type.

CONCLUSIONS

In conclusion, we wish to state that the diagnosis in Case 2 is open to criticism. However, the term elephantiasis is a generic one only and may be applied to various anomalies. Congenital elephantiasis bears no relation whatsoever to the tropical form of the disease.

AN UNUSUAL SEQUEL OF MENINGITIS

LESION OF THE CONUS MEDULLARIS *

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REPORT OF CASE

F. W., a girl, aged 2½ years, was admitted to the Harriet Lane Home of the Johns Hopkins Hospital on June 6, 1921, suffering from cerebrospinal meningitis of two days' duration. Meningococci were present in smears and cultures of the spinal fluid. Between June 6 and June 28, lumbar puncture was performed seventeen times, and fourteen injections of antimeningococcus serum were given intraspinally. All the spinal punctures were done in the fourth lumbar interspace except one or two, which were in the third interspace. No difficulty was ever experienced in performing the punctures and a "bloody tap" was never obtained. During the first ten days of the disease, the child was unable to void and the bladder frequently extended to the umbilicus, necessitating manual expression. After the tenth day, however, the bladder was never distended and the child voided in her bed. The bowels moved only with enemas during the first three weeks of the illness. After this time, there was a period of slight diarrhea, which improved after restriction of the diet. The child was discharged from the hospital on July 11, apparently completely recovered. Both stools and urine were passed in the diaper, but because of her age no attention was paid to this.

Two years later, May 17, 1923, the mother brought her back to the Harriet Lane Dispensary because of an ulcer which had developed in the anal fold. About four weeks before the mother had noticed a "reddish chapped" area on the skin between the buttocks, and posterior to the anus. On May 13, this had "split open" and formed an ulcer. The child complained of no pain. At this time, the mother stated that from the age of 19 months until she had developed meningitis, the child had always had perfect control of the bowels and bladder. After returning home from the hospital she had been incontinent, but after about a year, she had gradually recovered control of the bowels. The loss of bladder control had persisted longer; although of late there had been some improvement, as a rule, she still voided involuntarily both night and day.

Examination.—An oval ulcer about 3 cm. long was situated in the anal fold along the median raphé, and extended from about 2 cm. posterior to the anus to the tip of the coccyx. The margins of the ulcer were sharply punched out with no surrounding inflammatory reaction. The base was granular and covered with a slight grayish exudate. Surrounding the ulcer was an area of total anesthesia with a radius of about 10 cm., as shown in the photograph. The external sphincter appeared to be relaxed and the anal reflex and the gluteal reflex could not be obtained. The knee jerks and the ankle jerks were elicited with difficulty. The results of the remainder of the general and neurologic examinations were negative. A roentgenogram of the lower part of the spine revealed no evidence of spina bifida. There was fusion of the fifth lumbar vertebra on the right side with the sacrum, a condition not at all uncommon, which could in no way account for the neurologic lesion. The blood Wassermann and the intradermal tuberculin tests were negative.

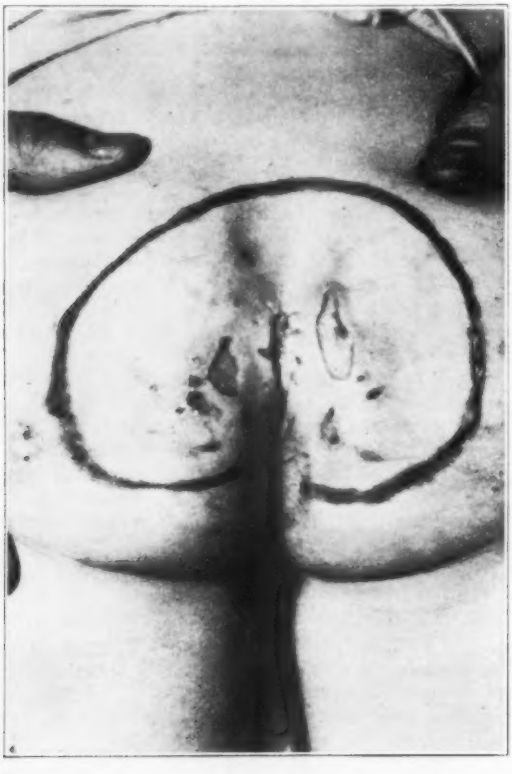
A diagnosis was made of a lesion of the fourth and fifth sacral segments of the cord (the conus medullaris) which had resulted from meningitis. The

* Received for publication, Oct. 21, 1924.

* From the Harriet Lane Home for Invalid Children, Johns Hopkins Hospital.

child was transferred to the surgical service, and on May 26, the ulcer was excised and the edges of the wound approximated with sutures. Following the use of iodin at the operation, the buttocks became blistered, and excoriations developed on both sides of the excision. The rate of healing was very slow, but gradually both the original ulcer and the excoriations healed, and the patient left the hospital on June 21.

The child was examined again on Aug. 1, 1924. She then had perfect control of the bowels. There had been considerable improvement in the bladder control, but there was still incontinence during the day though never at night. The anal reflex was still lacking. The area of complete anesthesia persisted, but no other trophic lesions had developed.



Black line, area of total anesthesia. Trophic ulcer and excoriations from iodin are shown.

COMMENT

It is exceedingly rare to find spinal lesions following meningitis. Two types have been described. In the first there are flaccid paralyses which may be localized to one limb or even to an individual muscle. Associated sensory changes are irregular in distribution. Such lesions are due to the involvement of nerve roots, probably as a result of purulent infiltration of their pia-arachnoid sheaths as they pass out from the cord. The nerves of the cauda equina may be involved in this manner.

Complete recovery usually results, although the condition may persist for several months. The second type of lesion, which is even rarer than the first, involves the spinal cord itself and presents the signs characteristic of myelitis. The injury is usually permanent. Sophian [1] and Worster-Drought and Kennedy [2] have each described cases in which there was a complete transverse lesion of the cord in the lumbar segments. I have been unable to find in the literature an instance in which such a lesion was confined to the conus medullaris as in the case that is reported here.

The possibility that this lesion was the result of trauma during the lumbar puncture, rather than of the meningitis cannot be excluded. In the adult, the spinal cord seldom reaches below the first lumbar vertebra, but in very young children it may occasionally extend to the level of the fourth lumbar vertebra. Our patient's punctures were performed between the fourth and fifth and between the third and fourth lumbar vertebrae, and, conceivably, the cord might have been injured. However, that such lesions may follow meningitis independent of lumbar puncture, is proved by the case cited by Sophian in which a complete transverse lesion of the cord developed before any lumbar punctures had been performed.

SUMMARY

A case is reported in which a permanent lesion of the fourth and fifth sacral segments followed meningitis. Lesions of the spinal cord are an exceedingly rare sequel of this disease. Although it is conceivable that such an injury may be due to lumbar puncture, it has been shown that the lesion may occur even when puncture has not been performed.

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1. Sophian, A.: Epidemic Cerebrospinal Meningitis, St. Louis, C. V. Mosby Co., 1913, p. 287.
2. Worster-Drought, C., and Kennedy, A. M.: Cerebrospinal Fever, New York, The Macmillan Co., 1919, p. 495.

STUDIES ON THE SALIVARY UREA INDEX IN CHILDREN *

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AND
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In the pediatric and general clinic of any hospital, many cases of albuminuria are discovered by the routine examination of urine in all dispensary patients. The albuminuria in these cases is due to various causes, including anemia, focal infections, orthostasis, malnutrition or faulty diets and minor respiratory infections besides the actual cases of nephritis. Many nephritis patients do not have nitrogenous retention, but it is of dietary importance to determine the presence or absence of such retention.

Complicated chemical studies are impracticable in adult dispensary work and more or less impossible in pediatric clinics. Hence the importance of the salivary urea index of Hench and Aldrich,[1] a simple clinical test which, by denoting urea retention in the body and the blood, indicates the presence or absence of certain definite types of nephritis (those associated with nitrogenous retention). By the test which may be done readily in from five to fifteen minutes with two simple reagents, the less important forms of albuminuria may be separated from those of more pathologic significance.

The present study of the salivary urea index, made on 196 children, was carried out to determine the value of the test originated and described by Hench and Aldrich. Most of their investigations were conducted on adults, only about twenty out of 500 patients being juveniles. Consequently, we have attempted to carry on these investigations in children.

It is generally accepted that the determination of most value in estimating the retention of nitrogenous end-products of metabolism is the blood urea. Naturally, it is much simpler in most cases to obtain saliva on which to perform a simple test than blood from a vein on which to perform a more difficult one, providing approximately the

* Received for publication, Aug. 25, 1924.

* From the Pediatric and Albuminuria Clinics of the Michael Reese Dispensary.

1. Hench, P. S., and Aldrich, Martha: The Concentration of Urea in Saliva, J. A. M. A. **79**:1409 (Oct. 21) 1922; A Salivary Index to Renal Function, ibid, **81**:1997 (Dec. 15) 1923; Apparatus for the Determination of the Salivary Urea Index, ibid, **82**:1194 (April 12) 1924; M. Clin. N. Am. **7**:123-134 (July) 1923.

same information can be obtained. However, if the vein can be easily entered, as in adults, and proper laboratory facilities are at hand, it is sufficiently simple to determine the blood urea content. In children, however, it is often difficult to draw blood successfully from a vein, a procedure which is always painful and terrifying to the patient. It is often accompanied by much struggling and screaming, making it difficult or undesirable to perform in the office or dispensary. If the salivary test in children proves sufficiently reliable for clinical purposes, it will be resorted to more frequently and less hesitantly than the blood determinations.

Urea is easily diffusible and is almost uniformly distributed in all tissues and fluids of the body.[2] Ninety-three per cent. of a standard solution of urea will dialyze in twenty-four hours.[3] Hench and Aldrich [1] have demonstrated that the concentration of urea in saliva is practically the same as the concentration of urea in the blood. These authors have found that the greater part of the salivary ammonia nitrogen is a product of urea by hydrolysis, and so the salivary urea must be estimated from the combined urea and ammonia nitrogen present. Quoting from them: "The average value of urea concentration in the saliva is approximately 80 per cent. of that of the blood urea. In cases of urea retention the combined ammonia and urea nitrogen of the saliva is increased in definite amounts and closely parallels the urea nitrogen of the blood." These findings have been corroborated by Schmitz [4] and Landsberg.[5]

Hench and Aldrich proceeded to perfect a rapid, simple method for estimating a salivary urea index. The method consists in determining the mercury combining power of the saliva. Some mercury salts, such as bichlorid of mercury, combine with ammonia and urea nitrogen to form certain complex combinations of urea and mercuric oxid. The proportion of mercury combining with other salivary substances, such as amino-acids, mucin, uric acid, etc., averaged 35 per cent. Morris and Jersey [6] have proved that the variability of the urea and ammonia content of the saliva is only slightly affected by the stimulation of the glands by paraffin.

Fresh specimens of saliva should be used, or the saliva should be boiled for ten seconds to stop the decomposing action of bacteria and enzymes.

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2. Marshall, E. K., Jr., and Davis, D. M.: J. Biol. Chem. **18**:53, 1914.
3. Chauffard, A.; Brodin, P., and Grigaut, A.: Ann. de méd. **12**:257 (Oct.) 1922.
4. Schmitz, H. W.: J. Lab. & Clin. Med. **8**:78 (Nov.) 1922.
5. Landsberg, M.: Klin. Wchnschr. **2**:306 (Feb. 12) 1923.
6. Morris, J. L., and Jersey, V.: J. Biol. Chem. **56**:31 (May) 1923.

The technic of the test, according to Hench and Aldrich, is as follows:

COLLECTION OF SPECIMENS OF SALIVA

The mouth is washed with one-half glass of water, and a small piece of paraffin is used to stimulate the salivary flow. Two specimens, each of about 8 c.c., are collected. The first, or preliminary specimen, which removes food particles or excess of epithelial débris, is discarded or may be used as a check on the second specimen, which is used for titration. Filtration of saliva is unnecessary.

MERCURY TITRATION

Two solutions are used, a 5 per cent. solution of mercuric chlorid and a 7 per cent. (saturated) solution of sodium carbonate (anhydrous). The latter is approximately equivalent to a 20 per cent. solution of sodium carbonate crystalline ($NA_2CO_310H_2O$) or 8.5 per cent. of monohydrated sodium carbonate U. S. P. To 5 c.c. of saliva in a small flask or tube is added the mercuric chlorid solution from a buret until a test drop of the titrated saliva, when added to a drop of the sodium carbonate on a white tile, shows a prompt formation (within three seconds) of a definite brown precipitate of mercury oxychlorid, which is formed by the combination of excess mercuric chlorid and sodium carbonate. It was found that 5 c.c. of the saliva requires a minimum of 1.5 c.c. of mercuric chlorid. Hence, this amount should be added before a test drop is removed.[7] As titration progresses, a deepening canary yellow appears on adding the test drop to the soduim carbonate, but the true end point is the first appearance of a reddish brown precipitate.

This titration measures the total mercury combining power of the saliva. The appearance of the oxychlorid shows that the mercuric chlorid has ceased to combine with substances in the saliva and is free to react with the carbonate. The titration figure for 5 c.c. of saliva multiplied by twenty gives the number of cubic centimeters of mercuric chlorid used for 100 c.c. of saliva. The mercury combining power of 100 c.c. of saliva we have called the "salivary urea index."

Hench and Aldrich found a distinct and continuous parallelism of the three values (blood urea, salivary urea and salivary urea index), as the urea increased and decreased in the blood. The salivary urea index varied directly with changes in the concentration of urea in the saliva and blood. Thus, the information gained from one estimation

7. Because of the lower values encountered in children, a minimum of 1.2 c.c. of mercuric chlorid was added to each 5 c.c. of saliva at the beginning of the titration.

was of similar value to that obtained from the other two. In 92 per cent. of their estimations on normal persons with normal blood urea content, the salivary urea index value was between 30 and 50 (that is, from 30 to 50 c.c. of 5 per cent. mercuric chlorid for each 100 c.c. of saliva). Also 91 per cent. of patients with urea retention in the blood gave a salivary urea index over 50 c.c. The higher the blood urea was found to be, the higher was the salivary index.

By a scheme of charting the salivary urea index and corresponding blood urea values, a mathematical formula was worked out by Hench and Aldrich for the probable equivalents of blood urea.[1] They state that: "Thus the probable equivalent of any salivary urea index may be obtained in terms of blood urea; B (probable blood urea) equals 1.43 multiplied by S (salivary urea index) minus 34. However, it is sufficient to know that high salivary urea indexes denote nitrogen retention in the blood.

"In the normal range of blood urea values, from 12 to 40 mg. for each hundred cubic centimeters, the salivary urea index varied somewhat indiscriminately between 30 and 50, but above 40 mg. the variability is less significant. The parallelism between blood urea and salivary urea index is sufficiently well established, and therefore a high salivary urea index can be accepted by itself as an indication of urea retention."

The summary of the results of our investigations are expressed in the following tables:

TABLE 1.—*Normal Cases, no Blood Urea Tests*

Cases	Age, Years	Diet	Salivary Urea Index			Urine	Remarks
			Minimum	Maximum	Average		
82	2½ to 16	General	23	50	35	Albumin 0 Casts 0	Slight amount of blood in two specimens of saliva

TABLE 2.—*Moderate Albuminuria, no Blood Urea Tests*

Cases	Age, Years	Diet	Salivary Urea Index			Urine
			Minimum	Maximum	Average	
59	3 to 13	General	27	50	36	Albumin trace Casts 0
29	6 to 15	One on a low protein diet, others on general	29	50	38	Albumin 1 plus Casts 0
3	8 to 9	General	29	36	32	Albumin 2 plus Casts 0

TABLE 3.—*Nonnephritic Cases on Which Blood Urea Tests Were Made*

Cases	Age, Yrs.	Weight, Pounds	Diet	Salivary Urea Index	Blood Urea	Urine	Remarks
1	6	50	General	26	A 19*	Negative	
					B 3		
2	13	91	General	38	A 20	Negative	
					B 20		
3	11	68	Low protein	31	A 13	Negative	
					B 10		
4	12	80	General	44	A 22	Albumin trace	
					B 20	casts 0	
5	7	48	General	32	A 23	Albumin trace	
					B 12	casts 0	
6	9	45	General	38	A 23	Albumin trace	
					B 20	casts 0	
7	7	92	General	32	A 23	Albumin trace	
					B 11	casts 0	
8	10	123	General	38	A 17	Albumin trace	
					B 20	casts 0	
9	7	32	General	41	A 18	Albumin 1 plus	
					B 24	casts 0	
10	10	56	General	60	A 25	Albumin 1 plus	Patient chewed 1½ hours
					B 52	casts 0	second urea value ob-
					16		tained after 1 week
11	4	38	General	54	A 18	Albumin 1 plus	Patient chewed 2 hours
					B 42	casts 0	
12	7	76	General	30	A 25	Albumin 2 plus	
					B 22	casts 0	
13	14	108	General	30	A 15	Albumin 2 plus	
					B 10	casts 0	
14	8	60	General	32	A 20	Albumin 2 plus	
					B 12	casts 0	
15	4	35	Low protein	24	A 18	Albumin 2 plus	
					B 0†	casts 0	

* A equals actual blood urea value determined chemically by the urease method. B equals probable blood urea value computed with formula from the salivary urea index.

† The salivary urea index here was quite low, therefore the mathematical interpretation would indicate an absence of blood urea, which is of course merely an error in the formula as applied in low normals and not an error in the test itself.

TABLE 4.—*Nephritic Cases, no Urea Retention*

Cases	Age, Yrs.	Weight, Pounds	Diet	Salivary Urea Index	Blood Urea	Urine	Remarks
1	9	..	Low protein	38	A 24*	Albumin 1 plus	Acute hemorrhagic ne-
					B 20	casts 1 plus	phritis 2 months before salivary determinations were made; nonprotein nitrogen equals 42 mg.
2	13	61	General	34	A 22	Albumin 4 plus	Chronic nephritis of 3
					B 0†	casts 1 plus pus 2 plus	years' duration
3	10	64	Low protein	34	A 20	Albumin 4 plus	Chronic nephritis of 3
					B 15	casts 1 plus	years' duration
4	6	40	Low protein	35	A 15	Albumin 4 plus	Chronic nephritis of 1
					B 16	casts 2 plus	year's duration

* A equals actual blood urea value determined chemically by the urease method. B equals probable blood urea value computed with formula from the salivary urea index.

† The salivary urea index here was quite low, therefore the mathematical interpretation would indicate an absence of blood urea, which is of course merely an error in the formula as applied in low normals and not an error in the test itself.

TABLE 5.—*Nephritic Cases, Urea Retention*

Cases	Age, Yrs.	Weight, Pounds	Diet	Salivary Urea Index	Blood Urea	Urine	Remarks
1	6	34	General	63	A 57* B 56	Albumin 4 plus pus 4 plus casts 1 plus	Pyelonephritis, 6 months' duration; discharging mastoid for 3 years
2	9	55	Low protein	84	A 80 B 86	Albumin 3 plus casts 2 plus	Chronic nephritis, 2 years' duration
3	5	38	Low protein	75	A 68 B 73	Albumin 3 plus casts 3 plus	Chronic nephritis, 1 year's duration
4	12	70	Low protein	105	A 110 B 116	Albumin 4 plus casts 4 plus blood 4 plus	Acute nephritis; impending uremia
5	5	42	Low protein	80	A 92 B 81	Albumin 3 plus casts 2 plus	Chronic nephritis, 2 years' duration
6	8	47	Low protein	60	A 58 B 58	Albumin 3 plus casts 2 plus	Subacute nephritis, 6 months' duration

* A equals actual blood urea value determined chemically by the urease method. B equals probable blood urea value computed with formula from the salivary urea index.

SUMMARY AND COMMENT

1. The salivary urea index was determined in 196 children, whose ages ranged from 2½ to 16 years; eighty-five had normal urines, 111 had albumin in the urine, of which ten had definite evidence of nephritis. Blood urea determinations were made on twenty-five of these children (three with normal urinary findings and twenty-two with albumin in the urine, of which ten had definite evidence of nephritis).

2. The normal lower limit of the salivary urea index in adults, as established by Hench and Aldrich, was 30. The salivary urea index in our series generally averaged lower than those of adults. The lowest index was 23, in a child aged 9 years; the upper limit was 50 and the average 35. The age range apparently made little difference among the children studied, those above 8 years averaging 35.8 and those below 8 averaging 34.8. Twenty-three of the total number of salivary indexes determined were below 30, of which thirteen patients had negative urines and ten had some albumin in the urine. The lower trend of the figures in children corresponds to the generally accepted lower averages of normal blood urea, perhaps due to a lower protein intake. The relation of the level of the salivary urea index to the protein content of the diet is now under investigation by us and the results will be published in a subsequent paper.

The youngest child in our series was 2½ years of age. We found it too difficult to get the cooperation of younger children to complete the necessary chewing and expectoration. Several children were aged 4 years, the oldest was 16. Most of the children between 3 and 6 years, on the whole, cooperated readily, especially when the parent or attendant was near to watch the child and encourage chewing and expectoration. Ten children between the ages of 3 and 8 years would not cooperate or were unable to understand what was wanted. In two cases in which cooperation was poor and two hours elapsed before a sufficient quantity

of saliva was collected, the salivary index was above 50, although the blood urea was normal. This can probably be accounted for by the autolytic changes in the saliva while standing.

In three cases small amounts of macroscopic blood from the gums were present in the saliva. This apparently did not appreciably change the index values, which varied among them from 36 to 48.

3. We included in our series 111 children whose urine revealed albumin, varying from a trace to 4 plus. Ninety-nine (albumin from trace to 2 plus, no casts to occasional ones) had a normal salivary index. Two others of this group had a high index but had chewed for two hours (discussed elsewhere). Of the ten children with definite marked nephritis studied, four had a normal salivary index ranging from 34 to 38 and six showed a high index from 60 to 105, denoting urea retention, which was confirmed by blood studies, the blood urea in the first four patients ranging from 15 to 24 mg. and in the last six from 58 to 110. The albuminurias of mild grade, without evidence of serious kidney damage, did not average any higher salivary index than did the normal cases studied.

4. No patient showing a salivary urea index below 50 on which a blood determination was also made showed a blood urea value over our accepted upper normal limit (25 mg.) and vice versa, the only children whose salivary index was over 50 and whose blood urea was normal were the two who chewed for two hours, allowing autolysis to progress in the expectorated saliva.

5. The six patients (other than the foregoing two) which had a high salivary index (over 50) had correspondingly high blood urea values and all were nephritic patients.

6. The formula, B equals 1.43 multiplied by S minus 34, did not always comply closely when the values were within normal limits, but when the figures were abnormally high, the formula applies much more closely, as can be seen in the table. This slight mathematical error is due to physiologic variation, which is more often present in normal persons and does not in any way change the value of the test. In this we agree with Hench and Aldrich, who state that: "In the normal range of blood urea values the salivary urea index varies somewhat indiscriminately (between normal limits), but with a blood urea value above 40 mg. per hundred cubic centimeters, the variability is less significant."

CONCLUSIONS

The results of our investigations on the salivary urea index in children agree essentially with the work done by Hench and Aldrich more especially in adults. There is a distinct correspondence between the salivary urea index and the blood urea value. The salivary index

definitely indicates the presence or absence of urea retention in the body and in the blood. Although the salivary urea index does not give absolutely accurate figures for the blood urea, a clinically approximate estimate of the blood urea is obtained in retention cases by the application of the formula.

We believe that this test is especially applicable to children because of the ease with which a specimen of saliva may be obtained, with no discomfort to the child, as contrasted with the disturbance usually created in obtaining a specimen of blood, especially in ambulatory cases. As suggested by Hench and Aldrich, it can be used as a routine method in cases of suspected retention, or in any other cases (especially albuminurias) where the nonprotein nitrogen content is desired. If high indexes are found, denoting retention or a borderline case, further blood studies may be made. In protracted cases frequent salivary index tests may be made with occasional blood urea checks.

The salivary urea index should prove a very valuable adjuvant to the phenolsulphonephthalein test in the study of renal function.

THE EFFECT OF CHANGE OF REACTION ON THE GROWTH OF BACILLUS COLI AND STAPHYLOCOCCUS AUREUS*

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The good results repeatedly reported, obtained by changing the reaction of the urine in the treatment of pyelitis in infancy and childhood, led us to undertake a series of experiments to determine the effect of change of reaction on the growth of colon bacillus and staphylococcus. The work of numerous investigators has shown that the limits of the acidity and alkalinity of the urine are insufficient to check the growth of the colon bacillus. Shohl and Janney [1] found that the most rapid growth occurred between hydrogen-ion concentrations 6 and 7, and that at 5.4 and 8.4 the rate of growth was about the same. Growth was inhibited at the acid limit between 4.6 and 5, and at the alkaline limit between 9.2 and 9.6. The death point for bacteria is very near the inhibition point of growth. The authors noticed that for four hours there was no increase in the number of organisms in the urine, and that this latent period of growth, or lag, was longer in urine than in broth when twenty-four hour cultures were used. Barber,[2] Chesney, and others have shown that, when subcultures are made from bacterial cultures that are not growing at their maximal speed, this latent period of growth always occurs. Chesney [3] divided the life cycle of bacterial cultures into four phases: (1) the latent period, four hours, (2) the period of maximal rate of growth, fifth to ninth hour, (3) the stationary period, tenth to twelfth hour, and (4) the period of decline, after the twelfth hour. Only when the subculture is made during the second phase, the period of maximal growth, is the lag due to the age of the culture avoided. In studying the effect of change of reaction in the medium, it was, therefore, necessary to exclude the lag due to the aging of the cultures, so that all inoculations were made from cultures from four to five hours old, and controls were run with each experiment.

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* From the Section on Pediatrics, Mayo Clinic.

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2. Barber, M. A.: The Rate of Multiplication of *Bacillus coli* at Different Temperatures, J. Infect. Dis. **5**:379-400, 1908.

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EXPERIMENTS

Technic.—The mediums, plain broth containing 1 per cent. sodium acid phosphate or disodium phosphate, were titrated with sodium hydroxid to a hydrogen-ion concentration of 5.4 [4] and 8.4, a possible range in the normal urine, if we leave out of consideration the loss of carbonic acid. Five different strains of the colon bacillus, isolated from the urine of patients with pyelitis, were found to grow luxuriantly in these mediums. Strain 98, isolated shortly before from the urine and growing in dextrose brain broth, was used. It was a typical colon bacillus morphologically, fermented lactose, and grew well in both acid and alkaline broths. The reaction of the medium after growth was as follows:

TABLE 1.—*Hydrogen-Ion Concentration*

	Acid Broth	Alkaline Broth
Original	5.4	8.4
After twenty-four hours	5.6	8.4
After forty-eight hours	5.8	8.4
After seventy-two hours	6.0	8.4

This strain was grown in acid and in alkaline broth for two weeks with daily transfers. At the end of that period, the rate of growth of the twenty-four hour cultures in the same medium was determined. They showed the typical lag for about four hours which other observers have pointed out.

Growth of the Colon Bacillus, Strain 98.33, Growing in Acid and Alkaline Broth Inoculated into Fresh Broth of the Opposite Reaction.—The dilutions and platings were made immediately after inoculation and at hourly intervals thereafter. Duplicate plates were made, using 1 drop and 4 drops, and the average taken. For comparison, inoculations were made from acid to acid broth and from alkaline to alkaline broth. Four series of experiments were performed.

Series 1.—Twenty-four hour cultures were used for inoculation. Two experiments were carried out inoculating (1) acid broth with acid grown organisms, (2) alkaline broth with alkaline grown organisms, (3) alkaline broth with acid grown organisms, and (4) acid broth with alkaline grown organisms. In the first and second there was a latent period of from one to three hours; in the third and fourth a latent period of less than two hours and a very much more rapid growth than in the first and second. In the fourth there was a lag of four hours, and at the end of six hours the bacteria had scarcely increased in number, whereas in the other three they had increased rapidly after the third hour.

4. The usual indicator methods of Clark and Lubs were used for these determinations.

Experiment 1.—A tube of acid and one of alkaline broth were each inoculated with about 0.1 c.c. of a twenty-four hour culture of colon bacillus, strain 98.15, which had been growing with frequent, usually daily, transfers, in acid and alkaline broths respectively. Six hours later inoculations from these cultures were made as follows:

A, 0.1 c.c. culture in acid broth transferred to fresh acid broth.

B, 0.1 c.c. culture in alkaline broth transferred to fresh alkaline broth.

C, 0.1 c.c. culture in acid broth transferred to fresh alkaline broth.

D, 0.1 c.c. culture in alkaline broth transferred to fresh acid broth.

These cultures were diluted and plated immediately, and at hourly intervals thereafter. The dilution was 0.1 c.c. culture into a 10 c.c. sodium chlorid solution. One-tenth cubic centimeter of the mixture was plated, using duplicate platings. Buffered mediums were used. In the tabulations of experiments, the average from the duplicate platings is given.

TABLE 2 *(Experiment 1).—Number of Colonies on Plates*

Time	Inoculation A Acid to Acid	Inoculation B Alkaline to Alkaline	Inoculation C Acid to Alkaline
3:00 p.m.	5,600	9,200	3,500
4:00 p.m.	5,100	9,290	3,630
5:00 p.m.	10,000	9,050	6,780
6:00 p.m.	15,840	24,000	12,480
7:00 p.m.	17,600	35,200	17,600
8:00 p.m.	Innumerable	Innumerable	Innumerable
9:00 p.m.	Innumerable	Innumerable	Innumerable

In the transfer from acid to alkaline medium, the absence of lag in all experiments is striking; in fact there appears to be an increased rate of growth, particularly in Experiment 4. In Experiment 1 the acid grown organisms inoculated into alkaline broth were the only ones to increase during the first hour.

Experiment 2.—Twenty-four hour cultures of colon bacillus, strain 98.18 were used.

TABLE 3 *(Experiment 2).—Number of Colonies on Plates*

Time	Inoculation A Acid to Acid	Inoculation B Alkaline to Alkaline	Inoculation D Alkaline to Acid
2:30 p.m.	810	4,300	2,080
3:30 p.m.	970	4,420	2,780
4:30 p.m.	1,420	4,190	2,800
5:30 p.m.	3,360	5,520	2,080
6:30 p.m.	6,240	Innumerable	3,280
7:30 p.m.	12,000	Innumerable	3,920
8:30 p.m.	Innumerable	Innumerable	4,360

Series 2.—Four-hour cultures were used in order to overcome the lag due to the age of the culture, by the following technic:

Experiment 3.—This was a repetition of Experiment 1, using four-hour cultures of colon bacillus, strain 98.33.

TABLE 4 *(Experiment 3).—Number of Colonies on Plates*

Time	Inoculation A Acid to Acid	Inoculation B Alkaline to Alkaline	Inoculation C Acid to Alkaline
1:30 p.m.	9.0	77	13.5
2:30 p.m.	3.0	137	30.5
3:30 p.m.	3.5	205	56.5
4:30 p.m.	13.0	760	142.0
5:30 p.m.	12.5	2,624	706.0
6:30 p.m.	30.0	8,480	2,900.0
7:15 p.m.	55.5	8,320	6,400.0

Experiment 4.—This was a repetition of Experiment 3, using four-hour cultures of colon bacillus, strain 98.45.

TABLE 5 *(Experiment 4).—Number of Colonies on Plates*

Time	Inoculation A Acid to Acid	Inoculation B Alkaline to Alkaline	Inoculation C Acid to Alkaline
1:00 p.m.	13	37.0	20.5
2:00 p.m.	16	49.5	28.5
3:00 p.m.	51	100.0	50.0
4:00 p.m.	180	270.0	177.0
5:00 p.m.	389	1,225.0	1,300.0
6:00 p.m.	883	4,040.0	5,120.0
7:00 p.m.	2,190	8,400.0	11,840.0

Experiment 5.—This was a repetition of Experiment 4, using four-hour cultures of colon bacillus, strain 98.41.

TABLE 6 *(Experiment 5).—Number of Colonies on Plates*

Time	Inoculation A Acid to Acid	Inoculation B Alkaline to Alkaline	Inoculation D Alkaline to Acid
12:30 p.m.	19.5	45.0	32.5
1:30 p.m.	34.0	42.5	63.5
2:30 p.m.	38.0	36.5	55.0
3:30 p.m.	90.0	102.0	75.0
4:30 p.m.	335.0	415.0	159.0
5:30 p.m.	860.0	4,080.0	58.0
6:30 p.m.	1,590.0	6,640.0	380.0

Experiment 6.—This was a repetition of Experiment 5, using four-hour cultures of colon bacillus, strain 98.

TABLE 7 *(Experiment 6).—Number of Colonies on Plates*

Time	Inoculation A Acid to Acid	Inoculation B Alkaline to Alkaline	Inoculation D Alkaline to Acid
1:00 p.m.	11.0	43.5	3.5
2:00 p.m.	22.5	46.0	3.5
3:00 p.m.	47.0	44.0	4.5
4:00 p.m.	109.5	125.5	1.0
5:00 p.m.	275.0	700.0	3.0
6:00 p.m.	704.0	2,500.0	4.5
7:00 p.m.	4,000.0	6,420.0	11.0

The effect of transferring bacteria from alkaline to acid mediums is much more marked in that definite inhibition takes place in most instances. In Experiment 4, after six hours, the controls, acid to acid and alkaline to alkaline, show innumerable organisms. The transferred organisms in acid medium have not doubled in number. In Experiment 5, after five hours, they have not doubled in number, although after six hours there is considerable growth. In Experiment 6, in like manner, there is complete inhibition for six hours.

In order to determine whether the lag was peculiar to one particular strain of the colon bacillus, two other strains were tested in the same way. The technic was slightly modified in that the four different transfers were carried on at the same time, that is, acid to acid, acid to alkaline, alkaline to alkaline, and alkaline to acid. The counts represent averages from duplicate plates, as in the previous experiments. Each culture was transferred daily from acid broth to acid broth and from alkaline broth to alkaline broth until the day of the experiment. Up to 6:00 p. m. of the previous day the culture was transferred in the usual manner, and a fresh culture made in the morning. The first figures in each count represent the end of the four-hour period of growth of these cultures.

Experiment 7.—Bacillus coli communior was used.

TABLE 8 *(Experiment 7).—Number of Colonies on Plates*

Time	Inoculation A Acid to Acid	Inoculation B Alkaline to Alkaline	Inoculation C Acid to Alkaline	Inoculation D Alkaline to Acid
1:30 p.m.	249	434	138	96
2:30 p.m.	502	730	530	90
3:30 p.m.	1,108	900	3,030	57
4:30 p.m.	5,265	4,672	8,074	32
5:30 p.m.	6,890	12,800	9,440	84
6:30 p.m.	3,610	Innumerable	Innumerable	244

Experiment 8.—Bacillus coli communis, grown on acid and alkaline broth, was used.

TABLE 9 *(Experiment 8).—Number of Colonies on Plates*

Time	Inoculation A Acid to Acid	Inoculation B Alkaline to Alkaline	Inoculation C Acid to Alkaline	Inoculation D Alkaline to Acid
11:00 a.m.	5,360.0	10,560	.....	.....
12:00 m.	1,048.0	1,519	3,280	1,240
1:00 p.m.	31.0	720	Could not count confluence of colonies	707
2:00 p.m.	24.0	1,180	1,702	187
3:00 p.m.	4.0	856	1,366	173
4:00 p.m.	2.0	496	2,736	250
5:00 p.m.	0.5	272	Innumerable	348
6:00 p.m.	0.0	306	Innumerable	158

Experiment 9.—Bacillus coli communis, grown on acid and alkaline broths, was used.

TABLE 10 *(Experiment 9).—Number of Colonies on Plates*

Time	Inoculation A Acid to Acid	Inoculation B Alkaline to Alkaline	Inoculation C Acid to Alkaline	Inoculation D Alkaline to Acid
11:30 a.m.	6,480	7,808	7,280	640
12:30 p.m.	544	208	316	186
1:30 p.m.	1,188	704	548	198
2:30 p.m.	1,724	2,200	3,996	1,143
3:30 p.m.	3,030	2,776	4,416	876
4:30 p.m.	4,599	6,464	6,220	1,880
5:30 p.m.	Innumerable	Innumerable	Innumerable	1,992

Experiments 7, 8 and 9 show the typical reaction of acceleration of growth when the bacteria are changed from an acid to an alkaline medium. Experiment 8 was rather difficult to interpret and therefore was repeated. There was growth only in the transfer from acid to alkaline, and even here for a time there was a reduction in the count followed by a rapid increase. The mediums used in the experiment were the same as those in Experiments 7 and 9.

Series 3.—A similar series of experiments was carried out, using a staphylococcus isolated from the urine of a patient with pyelitis.

Experiment 10.—Staphylococcus, grown on acid and alkaline broths, was used.

TABLE 11 *(Experiment 10).—Number of Colonies on Plates*

Time	Inoculation A Acid to Acid	Inoculation B Alkaline to Alkaline	Inoculation C Acid to Alkaline	Inoculation D Alkaline to Acid
12:30 p.m.	45	105	21	36.0
1:30 p.m.	29	18	38	7.0
2:30 p.m.	26	19	57	6.0
3:30 p.m.	48	50	66	20.0
4:30 p.m.	32	44	28	10.0
5:30 p.m.	30	47	110	4.5
6:30 p.m.	49	33	60	26.0

Experiment 11.—Staphylococcus was used.

TABLE 12 *(Experiment 11).—Number of Colonies on Plates*

Time	Inoculation A Acid to Acid	Inoculation B Alkaline to Alkaline	Inoculation C Acid to Alkaline	Inoculation D Alkaline to Acid
12:15 p.m.	35.0	41.5	9.5	15.5
2:15 p.m.	4.5	87.0	38.5	45.0
4:15 p.m.	28.0	920.0	519.0	225.0
6:15 p.m.	77.0	2,400.0	1,500.0	1,161.0
8:15 p.m.	644.0	385.0	232.0	453.0
10:30 p.m.	2,284.0	Innumerable	2,000.0	4,940.0

Experiment 12.—Staphylococcus was used.

TABLE 13 *(Experiment 12).—Number of Colonies on Plates*

Time	Inoculation A Acid to Acid	Inoculation B Alkaline to Alkaline	Inoculation C Acid to Alkaline	Inoculation D Alkaline to Acid
11:30 a.m.	150.0	42.5	41.0	432.0
1:30 p.m.	0.5	416.0	137.5	8.2
3:30 p.m.	0.75	846.0	442.0	29.0
5:30 p.m.	0.25	3,330.0	5,440.0	302.0
7:30 p.m.	0.5	4,960.0	6,660.0	3,880.0
9:30 p.m.	0.0	Innumerable	Innumerable	3,840.0

Experiment 13.—Staphylococcus was used.

TABLE 14 *(Experiment 13).—Number of Colonies on Plates*

Time	Inoculation A Acid to Acid	Inoculation B Alkaline to Alkaline	Inoculation C Acid to Alkaline	Inoculation D Alkaline to Acid
11:45 a.m.	79.0	374	21	321
1:45 p.m.	1.0	602	136	11
3:45 p.m.	0.5	1,076	1,595	14
5:45 p.m.	1.0	1,824	3,544	148
7:45 p.m.	1.0	2,502	4,560	1,425
10:15 p.m.	0.5	Innumerable	Innumerable	Innumerable

The results in the foregoing experiments are not very uniform, but they show that the growth of the staphylococcus is much better in an alkaline than in an acid medium, and that acidity, such as can be easily brought about in the urine, is sufficient to prevent growth and even kill the staphylococcus.

Series 4.—A further modification of the technic was as follows: The colon bacillus was transferred from acid to alkaline, and from alkaline to acid broth every three hours. The mediums were the same as in previous experiments. The colon bacillus from a patient was used. It was transferred from dextrose brain broth to acid and alkaline broths in which the bacteria grew for three days, with daily subcultures to fresh mediums of the same hydrogen-ion concentration. Fresh cultures were made in acid and alkaline broths, inoculating from twelve-hour cultures of the same hydrogen-ion concentration. These two cultures, when four hours old, were used for inoculation in fresh mediums as follows: A, acid to acid; B, alkaline to alkaline; C, acid to alkaline, and D, alkaline to acid. Every three hours new subcultures from the last preceding culture were made: A and B into fresh mediums of the same hydrogen-ion concentration; C and D into fresh mediums of opposite hydrogen-ion concentration. For each inoculation 0.1 c.c. of the last culture was put into 10 c.c. of fresh medium. Dilution and platings were made at the time of each new inoculation. Plates were incubated for forty-eight hours. These frequent changes in reaction should have produced a marked slowing up of the growth of the colon bacillus, but as there was no marked effect, the detailed figures are not given.

CONCLUSIONS

1. The transfer of the colon bacillus, from an acid to an alkaline medium usually produces an increased rate of growth without lag.

2. The transfer of the colon bacillus from an alkaline to an acid medium is associated usually with a definite retardation of growth for a period as long as six hours in some instances.

3. *Staphylococcus aureus,* isolated from the urine, grows better in an alkaline than in an acid medium, and it would seem possible that sufficient urinary acidity might be produced to inhibit its growth.

PRENATAL APPENDICITIS WITH RUPTURE AND DEATH*

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The following case of appendicitis in a new-born infant is reported.

REPORT OF CASE

L., a girl, was the first born of twins. Labor occurred about three weeks before the calculated date of confinement. The child weighed 5 pounds 7 ounces (2,465 gm.); the twin, a boy, weighed 6 pounds 14 ounces (3,123 gm.). There was nothing abnormal about the pregnancy or delivery. The mother, aged 34, had always been in good health and had had four other children, all living and well.

On delivery, the child's abdomen was markedly distended, otherwise nothing abnormal was noted on careful physical examination. During the first day the child took sugar water and small amounts of a milk mixture but vomited practically all taken. The temperature remained normal; meconium was passed freely. The vomiting persisted.

During the second day the distension became more extreme; the use of enemas and the rectal tube did not diminish it. The temperature remained around 102 F. and the vomiting continued. The child died at 3:15 p. m. of the third day, fifty-five hours after birth.

Necropsy Report.—Weight of child 5 pounds, 6 ounces. Length, 19½ inches (49 cm.).

The infant was small. The skin was mottled; the face was cyanotic; there was practically no subcutaneous tissue. The abdomen was strikingly distended while the skin over this area was tense and shone. The abdominal circumference was 21 inches (53 cm.).

On incision, the peritoneal cavity was found to be filled with a straw colored clear fluid. The amount was about 1,300 c.c. The peritoneum was injected, was a bright pink and velvety to the touch. The intestines were matted together with many fibrinous adhesions. The stomach was distended with gas, the jejunum and ileum were distended to a point about 3 inches from the cecum. The terminal portion of the ileum was very dark red; the blood vessels were distended; the walls were quite thick and felt leathery on palpation. The cecum was thickened, dark and swollen. The engorgement extended about 2 inches beyond the ileocecal valve. The appendix was 2 inches long, was dark and swollen. It had a boggy feel when handled. At a point about one fourth of an inch from the junction of the appendix with the cecum there was a small perforation on the medial side. This perforation was less than one sixteenth of an inch in diameter; through it a small probe could be passed into the intestinal lumen. The appendix was filled with pus and débris.

The remainder of the necropsy was entirely negative.

On microscopic examination, the fluid from the peritoneal cavity was negative for bacteria, and failed to show any growth when planted on various mediums. Sections from the specimen were not made.

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We have been able to find two other cases similar to this in the literature. Jackson [1] reported a case of prenatal appendicitis in a new-born infant, who died of mercury poisoning, due to the accidental administration of a bichlorid tablet two days after birth. The acutely inflamed appendix together with the adhesions make it quite certain that the condition was present before birth. Reed [2] reported a case where the intestines had broken out along the umbilical cord; many adhesions were found and the appendix was inflamed. This child recovered after the appendix was removed and the intestines replaced in the abdominal cavity.

COMMENT

These cases and the one here reported make the conclusion unavoidable that peritoneal inflammation does exist in utero. In all three patients, fibrinous adhesions matting the intestines together were found, showing that the process had been in progress before birth. We questioned the mother of the child, but were unable to obtain any information that would throw any light on the possible etiology or time of onset.

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1. Jackson, W. F.: A Case of Prenatal Appendicitis, Am. J. M. Sc. **127**:170, 1904.

2. Reed, E. N.: Infant Disemboweled at Birth—Appendectomy Successful, J. A. M. A. **41**:199 (July 19) 1913.

PROGRESS IN PEDIATRICS

DISEASES OF THE GENITO-URINARY TRACT IN CHILDREN

A REVIEW OF THE LITERATURE FROM JANUARY, 1920, TO JANUARY, 1924*

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The recognition of the importance of the diagnosis and treatment of pyelitis in children is exemplified by the number of articles which have been written on this subject.

PYELITIS

Findlay[1] states, in a discussion of the etiologic factors, that there is a greater susceptibility of young children to infection in general, and a lessened resistance to infection; hence there is a definite age tendency. He thinks the route of infection is usually hematogenous, the infecting organisms being excreted by the kidney from the blood stream, and that certain influences, such as excessive numbers or special virulence of the bacteria, chills, defects in urinary drainage or undue distension of the bladder may aid in developing the active infection. He mentions especially that incomplete flushing of the urinary system, which predisposes to infection, and cites his experience with the frequent development of pyelitis in gastroenteritis patients, who had been treated by intraperitoneal injections of hypertonic salt solution, as proof that the absence of proper flushing of the urinary tract often brings on infection, since the treatment was always followed by diminished urinary output.

Dingwall[2] mentions the finding of pus cells and motile bacilli in the urine of apparently well children, and believes that there is a chronic infection of the urinary tract by the coliform bacilli and under these conditions it may be considered as a carrier state in the child and nonpathogenic. Imperfect health, however, may result in acute urinary inflammation and therefore preventive treatment should include dietetic and general hygienic measures. Therapeutic measures in chronic cases should include the restoration of the various bodily functions.

Helmholz and Millikin[3] discuss the frequent relation of infection of the upper respiratory tract to pyelitis, and state that the pyelitis may

* Received for publication, Dec. 18, 1924.

1. Findlay, L.: Remarks on Pyogenic Infection of the Urinary Tract in Infancy and Childhood, Glasgow M. J. **97**:28 (Jan.) 1922.

2. Dingwall, Fordyce A.: The Significance and Treatment of Some Abnormalities of the Urine in Children, Brit. M. J. **21**:97 (Jan.) 1922.

3. Helmholz, H. F., and Millikin, Frances: The Relation of Infections of the Upper Respiratory Tract to Pyelitis, J. A. M. A. **81**:1160 (Oct. 6) 1923.

be associated or secondary to these infections, although the exact relationship is not known at present. The theory is that infection of the nose and throat lowers the resistance of the patient to such an extent that the colon bacillus is permitted to acquire a foothold in the urinary passages, where it sets up an inflammatory reaction, and that the actual bacteria of the primary infection in the upper respiratory tract do not actively cause the secondary pyelitis since the colon bacillus is almost invariably found in the urine. Investigations were made by the authors of the relationship of extra-urinary infection and pyelitis in infancy and childhood, where the pyelitis was secondary to known infection of the upper respiratory tract, such as otitis media, acute tonsillitis and old infected tonsils and carious teeth. Inoculation of the organisms from the primary and secondary infections were made in dextrose brain broth, and twenty-four hour growths were injected intravenously into rabbits. The results indicate that the bacteria isolated from the throat have a greater tendency to localize in the kidney than the colon bacilli which were isolated from the urine. However, no evidence was found that the primary infection acts specifically, but it probably does produce a general lowering of the resistance of the urinary tract so that the colon bacillus is more apt to develop and produce inflammation.

Ryder [4] mentions an etiologic analogy of urinary tract infection in children to that of adults. He states that the colon bacillus is the most common bacterial etiologic factor, but that other organisms occasionally found are staphylococci, streptococci, typhoid, paratyphoid, proteus, pyocyaneus, influenza and paracolon bacillus. Infection may result from direct extension through the urethra by migration of bacteria through the intestinal wall into the bladder and by the hematogenous route. He recommends Donné's reaction as a valuable aid within certain limits of the course of the infection, since it indicates an approximate increase or decrease in the number of pus cells. The test is made by the addition of a few drops of a solution of caustic soda to 5 c.c. of fresh urine. A more or less gelatinous consistency will result according to the amount of pus present.

Kretschmer and Helmholz [5] report that in a series of old pyelitis cases in infancy and childhood, a cure was obtained with lavage of the pelvis with a solution of silver nitrate. These infections had previously resisted all other forms of medication. This procedure can be carried out safely without any complications.

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4. Ryder: Infection of the Urinary Tract in Childhood and Donné's Reaction, Polska Gaz. **1**:767 (Oct.) 1922.

5. Kretschmer, H. L., and Helmholz, H. F.: The Treatment of Pyelitis in Infancy and Childhood, J. A. M. A. **75**:1303 (Nov. 13) 1920.

Dyson [6] states that treatment with potassium citrate, 10 grains three times daily, will alkalinize the urine, with resulting decrease in the number of pus cells and bacteria. He further states that acid sodium phosphate increases the acidity but does not improve the pyelitis. He found that 5 grains of benzoic acid, three times daily, did not increase the acidity or effect the number of pus cells and bacteria. Guiacol 4 minims, three times daily, resulted in clumping of the bacteria but did not seem to decrease the number. If more frequent doses were given, hematuria was likely to follow. He believes there is improvement in chronic cases when guiacol is given with forced fluid of three quarts of water a day. Vaccines did not improve the condition.

Langstein [7] does not favor catheterization of the kidneys or lavage of the bladder in very young children. He states that pyelitis in infants seldom occurs, but streptococci can always be found and occasionally *B. coli.* He believes infection is traceable to a reversion, and that the permeability of intestinal walls disappears at the end of the first year of infancy and then this type of pyelitis ceases.

Gittings [8] discusses the importance of the recognition of pyelitis, in order that proper treatment may be instituted to prevent the later development of renal and vesical calculi and pyonephrosis. Fever was the only symptom common to all eight patients in his series, but vomiting occurred in seven. Other symptoms varied from those of meningitis to a simple attack of functional diarrhea. Physical examination failed to reveal the cause of the attack in all instances, and symptomatic disturbances of the urinary tract occurred in only two patients. The urine was always acid in reaction, containing from a moderate to an excessive number of leukocytes, with more or less albumin. These findings suggest a diagnosis of pyelitis, but accurate determination of the extent of the disease can only be made with cystoscopic examination, catheterization and roentgen-ray pictures. It is important to remove possible foci of infection and secure free urinary drainage by giving large quantities of water by the stomach or nasal tube. Intraperitoneal methods must be used if vomiting persists. Complete alkalinization of the urine should be obtained, preferably by giving citrate of soda since bicarbonate is not so well tolerated by the stomach. Hypodermics of iron citrate may be indicated to combat the secondary anemia in severe chronic cases. Blood transfusion may be necessary in the very severe types, but

6. Dyson, J. E.: Effect of Pyelitis on Kidneys in Children, M. Clin. N. Am. **3**:1547 (May) 1920.

7. Langstein: Treatment of Pyelitis in Infancy, Therap. Halb. **34**:695 (Dec. 15) 1920; abstr., J. A. M. A. **76**:1543 (May 23) 1921.

8. Gittings, J. C.: The Occult Disease of Childhood, Internat. Clin. **1**:101, 1922.

in all severe and stubborn or persistent milder infections a urologist should be consulted.

Lozano [9] obtained favorable results with autogenous vaccines when given early and in conjunction with urinary antiseptics. A series of six injections were given, in increasing doses from 25 to 200 million bacteria with an interval of three days between injections.

Smith [10] emphasizes the frequent finding of *B. coli,* staphylococcus and streptococcus in the urine, without the presence of corresponding signs of inflammation of the urinary tract or any disturbance of health. The infections are classified as follows:

1. Bacterial infection without pathologic changes in the urine or other general or local pathology.

2. Primary bacterial infections with changes in the urine.

3. Infections with changes in the urine and complicating local pathology, such as congenital malformation, renal or bladder calculi, and general causes such as diarrhea, chronic constipation, and prolonged immobilization in plaster of Paris for spinal and hip diseases. Early and efficient treatment will prevent the infection from going into the stage of chronicity, as it is then difficult to eradicate.

A very complete summary of all phases of the subject is given by Helmholz.[11] He does not think that a diagnosis of the exact localization of the infection can be made from the symptoms and physical findings and therefore prefers the term pyuria. He states that many cases of so-called pyelitis are mild inflammatory conditions of the vagina. Pus in the urine may originate from the vagina, the urethra, the bladder, the ureters, the pelvis of the kidney or the substance of the kidney. Catheterized specimens from the bladder will readily differentiate pyuria of vaginal source from that of the urinary tract. Sterile urine containing pus may occur with or without the association of tuberculous lesions. Infections as a rule may be classified into one of the following clinical forms:

1. There may be a general pyemia, with abscesses in the cortex or medulla of the kidney. This type is nearly always hematogenous and usually due to an organism of the coccus group.

2. Renal involvement may occur as an acute exacerbation of chronic pyelitis with extension into the kidney. This pyelonephritic type without the formation of abscesses may result in anuria.

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9. Lozano, A. R.: Vaccine-Therapy in Purulent Urinary Diseases of Childhood, Arch. espan. de pediat. **6**:213 (April) 1922.

10. Smith, E. B.: Bacterial Infection of the Urinary Tract in Infancy and Childhood, Lancet **2**:595 (Sept. 22) 1923.

11. Helmholz, H. F.: Pyuria in Infancy and Childhood, Journal-Lancet **42**:553 (Nov. 15) 1922.

3. Multiple abscesses may occur due to breaking down of the kidney substance. There is obstruction of the urinary flow and the course is apt to be more chronic than other types.

4. Uncomplicated pyelitis may occur, which is usually severe at the onset, with high fever and chills but without local symptoms. The primary lesion is indefinite.

5. Pyuria secondary to infection outside the urinary tract frequently follows tonsillitis, bronchitis, otitis and other infections. Urinary symptoms are usually absent. An estimation of the number of pus cells can best be made from an uncentrifugalized specimen and then a differentiation from actual local infection can often be made.

Forced water is the most important single item in the treatment of pyelitis, and is the only treatment which has definitely proved to have a marked effect on the inflammation. The twenty-four hour fluid intake for infants of 1 year should be from 1½ to 2 quarts. The child will usually take more fluids if the amount of food is decreased. If sufficient fluids cannot be given by mouth, they may be given by other routes such as by rectum, intravenously, subcutaneously or intraperitoneally. Alkalis must be given in amounts large enough to insure alkalinity. Small infants are given 60 grains in twenty-four hours in divided doses and increased by 60 grains each forty-eight hours until the urine becomes alkaline. The therapeutic action of the alkalis is largely due to the diuretic effect. If good results do not follow alkalis and forced fluids, a change should be made to hexamethylenamin and acid phosphate.

Phenyl salicylate has not been of any value. Finally, if infection persists after the foregoing treatment, resort should be made to vaccines, ureteral catheterization and pelvic lavage.

Montes,[12] in a general review, mentions certain points under pathogenesis, symptomatology and treatment.

PATHOGENESIS

The seasonal incidence is most marked in summer when digestive disturbances are common. The majority of cases occur during the first year of life, and there is a predisposition of the female sex, since three-fourths of the author's cases occurred in girls. The colon bacillus alone or associated with other bacteria is the most common microbic cause of infection. It is usually secondary to disease outside the urinary tract. Montes believes the route of infection may be hematogenous, lymphatic or ascending.

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12. Montes, G. G.: Pyelitis in Infancy, Rev. med. Cub. **33**:164 (March) 1922.

SYMPTOMATOLOGY

Distinct clinical types may be observed such as the septic, typhoidal or meningitic, but in general the symptoms are inconsistent so that pyelitis must be considered in all cases of fever of obscure origin in infancy and the urine carefully examined. Headaches may be complained of by older children. Gastric disturbances, such as vomiting, diarrhea or constipation may be present. There is an indication of cystitis if vesical tenesmus is observed. There may be oliguria and polyuria. Leukocytosis is a rather constant finding. The urine is usually turbid but may be temporarily clear in unilateral infection and obstruction of the ureter on the affected side. Casts appear when pyelonephritis occurs. Highly virulent organisms or extension of the infection into the cortex is the usual cause of fatality.

TREATMENT

Montes recommends sufficient fluid intake to keep the specific gravity of the urine below 1,012. Hexamethylenamin is his drug of choice, with the acidity of the urine controlled by acid sodium phosphate. The original focus of infection especially should be treated in order to prevent reinfection. Vaccine therapy and ureteral catheterization did not give constant results.

NEPHRITIS

The significance of postural proteinuria and the differentiation from true nephritis is of interest. Harrison [13] states that true proteinuria probably never appears in the recumbent position, so that an organic lesion should be suspected if proteinuria occurs while the patient is lying in bed. Careful examination must be made to make sure that the protein does not come from the vagina or other parts outside the kidney. Posture is an important factor in causation but not the only one, since the protein sometimes disappears from the urine while in the upright position. He cites an instance of postural proteinuria which was observed over a period of several years. Intermittent attacks of two or three days duration were associated with certain mild symptoms, such as anorexia and slight vomiting. There was usually from six to eight weeks between the attacks. Two years later the child died of miliary tuberculosis. He considers the case of especial interest, since Mozzoloni regards postural proteinuria as possible evidence of incipient tuberculosis.

Lauener [14] notes that the albumin excretion is not always regarded as pathologic as formerly, and mentions reference to certain conditions

13. Harrison, G. A.: Observation on Postural Proteinuria, Lancet **2**:991 (Nov. 12) 1921.
14. Lauener, P.: Benign Albuminuria in School Children, Schweiz. med. Wchnschr. **52**:1170 (Dec.) 1922.

as physiologic albuminurias. Juvenile, cyclic or puberty albuminuria is generally considered to be albumin excretion during the age of development. An examination was made of the urine of 5,000 children. The children from 6 to 7 years of age had albuminuria in small quantities in 6 per cent. examined. The second group, from 10 to 11 years of age had albuminuria in 27 per cent. The third group, from 15 to 16 years of age, had albuminuria in 38 per cent. It was more frequent in girls than in boys. The excretion of albumin is not a puberty albuminuria, as it can be detected much earlier, but the condition apparently occurs at the time of greatest growth and therefore is better termed growth albuminuria. This corresponds to the finding of less excretion in the children of poorer classes in whom growth is slower. It is a condition of metabolism, and the kidney is not involved except as an organ of excretion.

Boyd[15] studied nephritis in the incipient stage in a number of children, and gave the results of his investigations in relation to the functional pathology. The most common etiologic factor was acute infection, and in twenty-six cases the sources were tonsillitis, scarlet fever, otitis media, nasopharyngitis, umbilical infection, mercuric chlorid and unknown causes. Daily urinalysis and chemical examination of the blood from time to time were made. Steady and rapid clinical improvement with higher functional tests and gradual lessening or disappearance of albuminuria indicated a resolving type with chronic glomerulonephritis. The nonresolving type with chronic glomerulonephritis or nephrosis was associated with nocturia and persistent casts in the sediment. Details of acute, chronic and fatal cases are given in the charts. Kidney functional tests are an aid in the determination of the prognosis and of the proper method of treatment. Blood nitrogen estimation and the concentration test in correlation with clinical observation are the most accurate indications of the probable final outcome. Calcium lactate is of value to combat the edema. A glomerulonephritis of the intracapillary type, with various degrees of degeneration in the cells of the convoluted tubules was the most common pathologic type in the acute cases. The chronic cases had additional scarring and fibrotic changes. Tubular changes predominated in the reported cases.

The infrequency of chronic diffuse nephritis in childhood is emphasized by Greene.[16] Clear, detailed accounts in the literature were found in only nineteen cases including his own. There was a clinical similarity of symptoms. Physical development was slow, with evidence of nutritional disturbance in early infancy. Bony deformities, often

15. Boyd, G.: Nephritis in Children, Am. J. Dis. Child. **23**:375 (May) 1922.
16. Greene, C. H.: Chronic Diffuse Nephritis in Childhood, Am. J. Dis. Child. **23**:183 (March) 1922.

similar to rachitis were frequently noted. English authors have described the cases as "renal dwarfism." Anemia and pallor are almost constantly present. The characteristic urinary findings, as in adults, are the following: pale, acid urine, and a large volume with low specific gravity. Albumin is variable but relatively small amounts are present constantly. The cardiovascular system had no marked change in younger children, but the change in the older children approached that of the usual adult cardiovascular picture encountered in chronic diffuse nephritis. He concludes that the renal lesion is primary and the arteriosclerosis and cardiac hypertrophy are secondary.

There were rather uniform pathologic findings in all cases. The kidneys were small, pale and atrophic with slightly adherent capsules. There was definite scarring of the kidney surface in more advanced cases. The cortex was atrophied and the cut surface pale. The glomeruli were hypertrophied in the least affected areas to atrophy with hyaline change in the older lesions. There was a variable but constant increase in the interstitial connective tissue in all cases. Although of obscure etiology, the author believes that the kidney lesion is primary and possibly of congenital origin. It is sometimes associated with other developmental defects.

Ashby [17] thinks the prognosis, as a rule, in nephritis of children, is more favorable than in adults, especially the more common secondary type such as that following scarlet fever, and attributes this to a less unfavorable effect of a rise in blood pressure in the younger cardiovascular system. The more rare primary type always has a bad outlook, with a duration of from three months to two years. Prognosis is influenced by the general condition of the patient and whether the attack is postscarlatinal or idiopathic. The urea concentration test has the greatest value for the determination of the outcome and should be made each week. A percentage of urea in the urine above 2 indicates fairly efficient kidneys. Ashby is not in favor of too great a protein restriction of the diet, since an increase in the urea of the blood causes diuresis. A soft diet is advised for ten days, then fresh eggs and meat are gradually added even in the presence of albuminuria. He advised against prolonged confinement to bed and believes that some exercise in a warm room lessens the edema.

Kaulen [18] describes skin hemorrhages in two cases of chronic kidney disease and uremia. These varied from small petechias to areas the size of a half dollar in the first case, which had a fatal ending. The

17. Ashby, H. T.: The Outlook of Nephritis in Children, Brit. M. J. **1**:408 (March 10) 1923.

18. Kaulen, G.: Hemorrhages in the Skin in Uremia, Monatschr. f. Kinderh. **22**:599 (Jan.) 1922.

histologic examination of the areas of bleeding showed infiltration of round and plasma cells about the vessels, with the presence of red blood cells in the tissue surrounding the vessels. Although the process was that of a toxic reactive inflammation of the blood vessels, sepsis as well as a blood or infectious disease could be ruled out. The second patient had numerous small petechial hemorrhages over the abdomen and many red blood cells in the urine along with leukocytes and casts. Repeated venesection and dietetic treatment was given, and the patient was discharged in six weeks in a good general condition. Uremia was the only cause for the hemorrhage into the skin, so far as could be determined from clinical observations.

The association of nephritis with impetigo contagiosa is described by Galtés.[19] It was more commonly seen in girls between the ages of 5 and 13, probably because there was a more favorable habitat for pediculus capitis with resulting erosions, which predisposed to the impetiginous lesion. The kidney localization was considered secondary to the streptococcus and staphylococcus skin lesions.

There is often no clinical evidence of renal involvement, but the examination of the urine reveals albumin. The cutaneous lesions should be treated simultaneously with the nephritis. Milk diet is usually sufficient treatment for simple albuminous nephritis. Galtés believes that any hereditary or acquired debility of the kidney, notably familial albuminuria, syphilis and tuberculosis, may predispose to involvement of the kidney in patients with impetigo contagiosa.

HYDRONEPHROSIS

Chaton [20] reports a case of hydronephrosis of the left kidney which at first was mistaken for a sarcoma, but diagnosis was made when it disappeared completely after polyuria. A giant kidney was found at operation and the etiology was a congenital stenosis of the ureter. Anastomosis was made between the lowest point of the kidney pelvis and the ureter below the stricture. A sound was left in the ureter and the kidney drained through the operative wound. The excretion of urine increased after the sound was removed and drainage from the operative wound stopped after two months. Complete recovery followed and the anastomosis was thought to be successful. The operation was done in the manner described because of the supposition that there was a unilateral kidney. Congenital stricture of the ureter is frequently an etiologic factor in hydronephrosis.

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19. Galtés, F. A. H.: Nephritis Impetiginosa, Rev. med. Cub. **33**:501 (July) 1922.

20. Chaton: Three Cases of Hydronephrosis, Bull. Soc. franç. d'urol. **8**:295 (Nov.) 1921.

Hyman [21] reports two cases of chronic retention of urine in children with ascending ureterohydronephrosis. A pyelogram of the first patient showed the ptosis of the right kidney with anterior rotation. The capacity of the pelvis of the right kidney was 4 c.c. more than the left. This girl of 6 years had had blood clots and pus in the urine, with frequency of urination. The second patient, a boy, aged 7 years, had pyuria. Cystoscopy under anesthesia revealed retention of urine in both kidneys. Roentgen-ray picture showed marked hydro-ureter on both sides. The phenolsulphonephthalein output in two hours was 17 per cent., which indicates the hopelessness of medical or surgical measures since the kidneys are damaged beyond repair.

A case of hydronephrosis due to kinking of the upper end of the ureter over an anomalous blood vessel is reported by Chalier and Vergnory,[22] which was removed through an anterior transperitoneal incision which they prefer in aseptic infections. There was no pus or albumin in the urine and urination was normal. The child was 13 years of age. He had pains in the left hypochondrium for one year. Congenital cyst had to be differentiated. As is frequently the case, the initial symptoms in the gastro-intestinal tract caused the genito-urinary tract to be overlooked. A thin-shelled kidney containing 1 liter of fluid was removed. The abnormal vessel came off from the renal artery, passing in front the ureter and supplying the lower pole of the kidney. The dilatation of the ureter above the vessel, with absence of any lower obstruction, seemed to indicate clearly that the anomalous vessel was the etiologic factor.

TUMORS

The differential diagnosis of neoplasms is discussed by Mixter,[23] especially from large solitary or multiple renal cysts, polycystic kidney and congenital hydronephrosis, all of which he considers to be of developmental origin.

An insidious onset is characteristic of malignancies. There are two types of neuroblastomas of the suprarenal: (1) a small primary suprarenal tumor with rapid and diffuse metastasis, and (2) large size tumor without metastasis which cannot be differentiated grossly from an embryoma. The so-called sarcoma is the other type of malignancy with all types of cells histologically, and the tumors are defined according to the preponderant cells but have a general classification of embryoma.

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21. Hyman, A.: Ptosis of a Kidney with Renal Stasis in a Child, Internat. J. Surg. **35**:126 (April) 1922.

22. Chalier, A., and Vergnory, M.: Voluminous Hydronephrosis Caused by Kinking of the Ureter Over an Abnormal Vessel, Bull. et mém. Soc. de chir. de Paris **49**:501 (March 27) 1923.

23. Mixter, C. G.: Tumors of the Kidney in Infancy and Childhood, Ann. Surg. **76**:52 (July) 1922.

Renal malignancies are common in infancy and occur more frequently in males than in females. There are no early symptoms and hematuria is rare. Loss of weight, intestinal symptoms, vomiting and abdominal distention are later symptoms. Neuroblastomas metastasize more freely, but embryomas tend to recur locally and the retroperitoneal glands and the peritoneum are invaded by extension. Early diagnosis is aided by roentgenography with inflation of the colon under ether anesthesia.

Large solitary or multiple cysts are more rare than congenital renal cysts. They are usually unilateral and the majority are probably retention cysts. The symptoms may be indefinite but the most common are abdominal fulness, dragging pain in the loin and negative urinary findings. The cyst should be enucleated and partial or complete nephrectomy done.

Polycystic kidneys are rare in infancy and are often bilateral. Symptoms may be absent even in the presence of extreme lesions but hematuria, growth of tumor or superimposed infection with uremia are later symptoms which focus attention on the tumor. Other congenital anomalies are often associated.

The extent and size of congenital hydronephrosis is dependent to a certain extent on the degree of stenosis and the position of the ureteral stricture. The uretropelvic junction is the most frequent site of obstruction in large unilateral types. Abdominal tumor is the most common symptom and urinalysis is negative in the absence of infection.

Gage and Adams [24] discuss the occurrence of embryoma of the kidney in infancy and early childhood. Grossly, the tumor may lie within a distended renal capsule or it may be entirely extrarenal. It may be solid or cystic. Microscopically, it usually appears as a rapidly growing cellular tumor with little stroma and characteristic cells without differentiation. The symptoms of anemia, loss of weight and hematuria, are seen only in the advanced cases. The outlook for operative relief is bad, since there is local recurrence within six months to two years after removal. Metastasis into the liver and lungs occasionally occurs.

The origin of mixed tumors of the kidney is from the mesodermal cell masses of the pronephron region of the embryo. Israël [25] emphasizes, therefore, that all forms of connective tissue substance and epithelial structures may be found in these tumors which originate from kidney blastema. Although the absence of urinary or general symptoms cause the disease to be overlooked during the early stage, the author emphasizes the importance of the temperature curve in patients with

24. Gage, H., and Adams, D. S.: Ebryoma of the Kidney, Ann. Surg. **78**:226 (Aug.) 1923.

25. Israël, W.: Renal Tumors in Childhood, Ztschr. f. Urol. chir. **17**:234, 1923.

malignant tumor of the kidney and suprarenal. Two cases are reported by this author.

Magoun and MacCarty [26] mention three views of the pathogenesis of malignant neoplasm as follows: (1) from the wolffian body, (2) from the embryonic kidney and (3) from aberrant cells of the myotome or similar structures. This has been accepted as the most probable theory. The results of their study of seven renal neoplasms are given by the authors. Microscopically, these tumors showed one type of cell in various stages of differentiation and with varying amounts of connective tissue. The authors classified the neoplasms as carcinoma of the adenomatous type because of the tendency of the cells to form gland-like structures, although there is no resemblance to normal renal tubules. The tumors were termed pseudotextomas because morphologically they are unlike any adult tissue cell. A further subdivision was made into three groups as follows: (1) textoblastomas, or those which are composed of cells so undifferentiated that it is impossible to recognize their textocyte development if differentiation occurred. These tumors are soft and vascular with rapid growth and metastasis. They may occur in any part of the body; (2) pseudotextomas with partially differentiated cells, which resemble in their arrangement certain normal adult cells without the exact morphology of adult textocytes, and (3) textomas which consist of differentiated cells which are morphologically like adult tissue cells. The growth of tumors in this group is slower than those in Groups 1 and 2.

Ravenna [27] reported a case of acute lymphadenosis, associated with bilateral renal sarcomatosis which progressed rapidly to death. Necropsy revealed splenomegaly, hypertrophy of the lymphatic glands and interstitial lymphocytomatosis of both kidneys. The kidneys grossly appeared as "large white kidneys," and microscopically lymphocytic round cells infiltrating all the intertubular and interglomerular spaces. The author mentions twenty similar cases in the literature, which were given under various names as bilateral infiltration, sarcoma of kidney, bilateral interstitial lymphocytomatosis of the kidney, and bilateral tubercular lymphadenosis of the kidneys.

GONOCOCCUS INFECTION

Valentin [28] gives her experience in the treatment of 161 cases of infantile vulvovaginitis. The course was suspended after from two

26. Magoun, J. A. H., Jr., and MacCarty, W. C.: Malignant Neoplasm of the Kidney Occurring in Infancy, Surg., Gynec. & Obst. **36**:781 (June) 1923.

27. Ravenna, F.: Acute Subleukemic Lymphadenosis and Bilateral Renal Sarcomatosis, Gior. di clin. Med. **3**:301 (April) 1922.

28. Valentin, I. E.: Recurrence in Infantile Gonorrhea, Deutsch. méd. Wchnschr. **47**:628, 1921.

to four weeks if negative for gonococcus, but there was a renewal of the discharge containing gonococci when examined after a month or several weeks. Repetition of the treatment caused the cessation of discharge and the disappearance of the gonococci in from four to eight weeks. The condition again recurred if treatment was interrupted. Some children had three or more recurrences which required confinement for more than a year. Valentin attributed the recurrences to the inaccessibility to treatment when the gonococci were in the glands or neighboring organs. Gonococci with recurrences were persistent in the rectum in sixty-one of the cases.

A report is made by Norris and Mikelberg [29] of seventy-four cases of uncomplicated gonorrhea in children. Tubal or ovarian infections are rare because of absence of menstruation. Gonorrhea in children is resistant to treatment, and usually becomes chronic with frequent recurrences due to undetected areas in the vagina. The vulva and the vagina are infected early but clear up under treatment, while the cervix, urethra and sometimes Bartholin's glands are more likely to harbor infections.

The child is prepared for treatment in the Trendelenburg position, hips well elevated and thighs wide apart. The external genitals and vulva are cleansed with 1 part of surgical solution of chlorinated soda in 99 parts of olive oil on cotton. Three drams of the solution is put into the vagina by means of a "Little Jumbo" dropper, which is quickly removed and the solution retained for two minutes by holding the labia. The excess of oil is wiped off. Treatments are given by the mother night and morning and by the physician twice a week. A card of instructions concerning gonorrhea is given to the mother. Intensive mercurochrome-220 soluble treatment is given later. Surgical solution of chlorinated soda in 0.5 per cent. should be used in very young children. After the discharge has stopped, the child is examined by a Kelly cystoscope introduced through the hymen which is incised if necessary. The child should be placed in knee chest or extreme Trendelenburg position after emptying the bladder and bowels. The vaginal examinations with the cystoscope are made at intervals of two weeks, one month, two months and final examination three and six months later. Bacteriologic specimens are examined in each instance.

There were eight recurrences out of sixty-three cases in this series, which included only those under continuous treatment and observation for three months after disappearance of evidence of infection. The average time for cure was twelve weeks. More extensive treatment is

29. Norris, C. C., and Mikelberg, H. B.: The Treatment of Gonococcal Infection in the Lower Genital Tract of Female Infants and Young Girls, Arch. Pediat. **39**:281 (May) 1922.

described for the conditions which do not clear up under the foregoing treatment, and this includes the use of speculum, cleansing the vagina with a 1:10,000 potassium permanganate solution, drying with a dentist's hot air bulb and finally painting vagina and genitals with 1 per cent. mercurochrome-220 soluble. The authors state that thoroughness and regularity are more important than the type of gonococcide used. Vulvovaginitis is a misleading term, since the cervix is always involved and often the urethra and the glands of Bartholin. Gram-stained films are useful but one or two negatives in the chronic stage are of little significance.

Rectal gonorrhea should be considered more frequently in children according to Lauter,[30] since there were microscopic lesions on the rectal mucosa in ten of fifteen new cases and seven of thirteen old infections of gonorrhea in children. Leukocytes and gonococci were found in every smear made from these deposits on the rectal mucosa. Lauter advises rectoscopy to obtain proper smears from the thick deposits.

LITHIASIS

Urinary calculi are rather common in early life, according to Thomas and Tanner.[31] The average age was 7.8 years and the youngest patient was 10 months old. Small stones are often passed after a supposed intestinal colic. The ratio of male to female is 3 to 1. The etiology is hard to determine, but certain localities predispose and infection is a definite factor. The ratio of the right kidney to the left is 21 to 8. In a series of 203 cases, 21 per cent. involved the kidneys or ureters and 8 per cent. were arrested in the ureter. Sixty-nine per cent. of the stones entered the bladder.

The symptoms are: pain and colic, hematuria, frequency of urination, pyuria, dysuria, and nausea and vomiting in the order of their occurrence. The passage of a ureteral stone seems relatively easy, possibly due to the ease of distention of the infantile ureter. The diagnosis is made from positive findings by the roentgen ray, cystoscopy, urinalysis and clinical findings.

Rectal administration of 20 grains of chloral hydrate in solution is a satisfactory anesthesia for the cystoscopy of babies. The stone may be palpated per rectum.

When the stones do not pass spontaneously, surgery is indicated but the majority of operations were done on the bladder and urethra. Out of 50 per cent. of the cases which could be followed up 2.5 per cent. had recurrences of symptoms. Patients with urinary stones may remain

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30. Lauter, L.: The Rectal Findings in Gonorrhea in Children, Deutsch. med. Wchnschr. **48**:1285 (Sept.) 1922.

31. Thomas, G. J., and Tanner, C. O.: Urinary Lithiasis in Children. J. Urol. **8**:171 (Aug.) 1922.

symptomless for years, and stones discovered during adult life may have been present since childhood.

The occurrence of a calcium carbonate stone in a child, aged 11 months, is reported by König.[32] A turbid urine containing albumin, leukocytes and phosphates persisted up to the seventeenth year, at which time a nephrotomy revealed fourteen concretions in the calices. These stones were composed of phosphate and carbonate. No urates were demonstrated. Constitutional factors have some relation to stone formation, since the calculous substances are held in solution by the colloids excreted by the kidney, and under certain conditions in the absence of these colloids, the crystalloids are precipitated and concretions are formed.

Licini [33] states that the bladder stones may have passed into the bladder from the kidney. In six cases of vesical calculi in children under 10 years of age, the composition of the stones was of calcium oxalate or urates alone or in combination. Two of the children had hereditary arthritis and three had infectious diseases complicated by toxic nephritis. In closing the bladder the catgut sutures should pierce only the muscular coat. The child is catheterized every six hours for a few days after operation.

According to Muzzi [34] vesical calculi in children has a somewhat different clinical and pathologic picture than bladder stones in the adult. The sedimentation in acid urine produces stones of the composition of uric acid, sodium urate, oxalic acid, cystin and xanthin. These calculi are almost always of renal origin and enlarge in the bladder from subsequent deposits. The sedimentation in alkaline urine consists of calcium, ammonium and magnesium phosphate or the association with urea and the formation of ammonium carbonate and ammonium urate. Here it is usually associated with pyelonephritis and cystitis. The author believes that an unbalanced diet influences the pathogenesis of calculus formation in infancy, whether exclusively vegetable or exclusively nitrogenous.

The occurrence is more frequent in males. The clinical symptoms which may be present are: urinary incontinence, frequent urination, interrupted urination, hematuria, pain at the end of the penis, frequent erections and tenesmus which may be associated with prolapse of the rectum. Cystoscopy or radiography establish the diagnosis. Suprapubic cystotomy is the operation of choice.

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32. König, F.: The Development of Kidney Stones in the First Few Weeks of Life, München. med. Wchnschr. **69**:1426 (Oct.) 1922.

33. Licini, C.: Bladder Stones in Children, Morgagni. Arch. **65**:330 (Sept.) 1923.

34. Muzzi, O.: Vesical Lithiasis in Infancy, Riforma med. **38**:298 (March) 1922.

TUBERCULOSIS

Eliasberg [35] says that tuberculosis of the kidney in children is frequently overlooked, because the possibility of its occurrence in children is not generally kept in mind. The kidney is infected through the hematogenous route from a primary focus in the thorax or abdomen. Early diagnosis is important but difficult because there are few symptoms and little fever. Disturbed urination and pyuria with absence of bacteria are suggestive. Sometimes erythrocytes are present in the urine. A peculiarity of tuberculosis of the kidney in childhood is the inability to detect other associated organic tuberculosis. The prognosis is usually worse than in adults and there is a greater tendency to further hematogenous effusion in children.

Eisenstaedt [36] reports a case of tuberculosis of the testis in a child, aged 3 years. The duration of the pain and the swelling in the left scrotum could not be determined. The left testes and epididymis was removed and the pathologist diagnosed diffuse productive tuberculosis of the testis. A review of the literature indicates that tuberculosis may be primary and even solitary so far as the genito-urinary tract is concerned. The tuberculosis of the testis in children is the reverse of adults, where it is secondary to tuberculosis of the epididymis.

Woll [37] reports two cases of tuberculosis of the penis as a result of ritual circumcision, in which hemostasis was obtained by sucking with the mouth. There was ulceration of the penis and swelling of the inguinal lymph glands. Deep exposure to the roentgen ray was successful in one patient, but the second patient died from intercurrent pneumonia. Of the fifty-six cases in the literature, all patients had swelling of the inguinal glands. Mild induration of the tissues rules out syphilis. Suppuration of the inguinal glands should be treated by puncture and injection of iodoform glycerin. The lesion on the penis should be treated by roentgen ray.

SURGERY OF GENITO-URINARY TRACT

The indications for urologic study in children are the same as for adults, according to Kretschmer,[38] but their verification is more difficult and the most frequent single indication is pus in the urine. Enuresis is another indication for cystoscopy. Sarcoma of the kidney is more frequently seen in children than in adults. The presence of blood was

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35. Eliasberg, H.: Renal Tuberculosis in Childhood, Jahrb. f. Kinderh. **99**:13 (July) 1922.
36. Eisenstaedt, J. S.: Tuberculosis of the Testis in a Child, J. A. M. A. **79**:2076 (Dec. 16) 1922.
37. Woll, E.: Circumcision Tuberculosis, Berl. klin. Wchnschr. **58**:153 (Dec.) 1921.
38. Kretschmer, H. L.: Urologic Surgery in Pediatrics, J. A. M. A. **79**: 286 (July) 1922.

found in the urine in eighteen of sixty cases. Roentgen-ray examination should be made in all instances and pyelography has a certain field of usefulness, but there are some cases of calculus that cannot be demonstrated by roentgen ray.

A definite routine examination of the urinary organs in children is suggested by Beer,[39] as follows: (1) analysis of catheterized specimens of urine, (2) physical examination with palpation of hypogastrium and lumbar region, (3) roentgen-ray examination, (4) cystoscopy and (5) blood for retention products. Beer names the urinary diseases in a series of eighty-five cases as follows: (*a*) one urethral calculus and two urethral strictures; (*b*) thirty cases of chronic retention of urine occurring in boys and usually due to contracture of the neck of the bladder; (*c*) two congenital diverticula; (*d*) stones in bladder from upper urinary tract; (*e*) inflammation of bladder without other pathologic changes; (*f*) diseases of the upper urinary tract (pyelitis); (*g*) hydronephrosis and hydro-ureter from obstruction by stone or stricture and also three cases from congenital malformation; (*h*) acute or chronic parenchymatous nephritis, in four of which decapsulation reestablished renal function; (*i*) three kidney stones; (*j*) perinephritic abscess which was a common condition secondary to cortical abscess; (*k*) nine cases of renal tuberculosis, and (*l*) nine kidney tumors.

Two cases are reported by Mouchet,[40] in children 8 and 9 years old. The symptoms were acute, with swelling of the scrotum, vomiting and fever. One was associated with volvulus of the testicle as a result of an abnormally long, thin and isolated pedicle. The course may be slow and progressive, but there is always an acute phase during which torsion takes place or becomes complete. The symptoms simulate acute orchitis but the latter condition is rare before puberty.

Spontaneous detorsion may occur, but because of hemorrhagic necrosis and testicular atrophy if detorsion does not occur early it is advisable to operate. After the testicle is untwisted it should be sutured to the tunica vaginalis. The testicle should not be removed unless necrotic.

Two cases of rupture of the bladder in children are reported by Groves.[41] The treatment of these patients is the same as for adults, and he urges immediate operation where there is suspicion of damage to the bladder. The author emphasizes that the abdominal cavity should be thoroughly cleansed by irrigation with warm physiologic sodium chlorid solution.

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39. Beer, E.: The Importance of the Recognition of Surgical Diseases in the Urinary Organs of Children, Internat. Clin. **3**:272, 1923.

40. Mouchet, A.: Torsion of the Spermatic Cord in Children, Paris méd. **12**:68 (July) 1922.

41. Groves, A.: Rupture of the Bladder, Canad. M. A. J. **13**:319 (May) 1923.

MISCELLANEOUS

Hematuria, in its relation to pediatric diagnosis, is presented by Leebron,[42] who classified hematuria according to frequency and importance as follows: (1) toxic, as in acute nephritis of infectious diseases; (2) blood dyscrasias as purpura, hemophilia, rickets, scurvy and leukemias; (3) injury from trauma or stone; (4) nephritic neoplasm, and (5) parasitic. It is important to determine the source and cause, since proper management and palliative treatment of rest and icebags should be used only to control the situation while searching for the etiology.

Fulton[43] says that the physiology of micturition is not a direct voluntary action but is an indirect action of the brain, which relaxes its inhibition of the spinal centers and permits the reflex to operate. He agrees with Glover that the nonorganic types are the result of neuromuscular fatigue. It is not a neurosis or stigma of hysteria but is the result of disturbed reflex. He outlines measures of treatment on the principles of improving muscular tone and increasing functional activities, and his patients have gradually improved under his routine of treatment which he cites in detail.

Hyman[44] states that routine use of cystoscopy will reveal many cases of diverticula of the bladder in children. These diverticula exist from birth, but acute symptoms may develop only after infection is superimposed. The site of predilection is in the vicinity of the ureteral orifices. All of his patients had a residual urine and pyuria.

Cystography should be done to determine the extent of the diverticulum. Nonoperative measures are useless, and the author states that radical extirpation of the sac gives the best results.

Frontz[45] emphasizes the frequency of congenital valves of the posterior urethra and spina bifida as the cause of chronic urinary retention in children. There are three general types of obstruction, as follows: (1) there is a ridge on the floor of the urethra continuous with the verumontanum, which divides into two fork-like processes extending toward the bulbomembranous junction. This is the most common type. (2) The second type is a cylindric ridge from the verumontanum to the internal sphincter. (3) The third type has no relation to the verumontanum and is found at different levels.

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42. Leebron, J. D.: The Significance of Hematuria in Children, Arch. Pediat. **40**:607 (Sept.) 1923.

43. Fulton, G.: Nocturnal Enuresis, Kentucky M. J. **19**:736 (Nov.) 1921.

44. Hyman, A.: Diverticula of the Bladder in Children, Surg., Gynec. & Obst. **36**:27 (Jan.) 1923.

45. Frontz, W. A.: The More Common Causes of Chronic Urinary Obstruction in Male Children, South. M. J. **15**:570 (July) 1922.

Cystography and cystoscopy are aids in the diagnosis. The operations are performed by the suprapubic route or the punch operation in older children. The outlook is good if seen before there is extensive damage to the upper urinary tract.

Abstracts from Current Literature

Anatomy and Physiology

VARIATIONS IN THE RATE OF EXCRETION OF THE ACETONE BODIES DURING THE DAY. ROGER S. HUBBARD and FLOYD R. WRIGHT, J. Biol. Chem. **61**:377, 1924.

Three subjects were given diets which caused the formation of acetone bodies. Urine was collected in two hour specimens during the day and in one night specimen. The rate of excretion of the acetone bodies was not constant during the day, and did not vary with the volume of urine excreted. The variations in the excretion seem to bear a relation to the time of meals.

ANTIKETOGENESIS. V. THE KETOLYTIC REACTION; ACTION OF GLYCOL ALDEHYD AND OF GLYOXAL. P. A. SHAFFER and T. E. FRIEDMANN, J. Biol. Chem. **61**:585, 1924.

This article deals with in vitro experiments on the oxidation by hydrogen peroxid in alkaline solution of aceto-acetates as affected by the presence of glucose, glycol aldehyd and glyoxal. The authors conclude that the ketolytic action of a hexose, is due to a Knövenagel condensation of glycol aldehyd with aceto-acetate to form a product which is easily oxidized.

A QUANTITATIVE STUDY OF SOME ORGANIC CONSTITUENTS OF THE SALIVA. HELEN UPDEGRAFF and HOWARD B. LEWIS, J. Biol. Chem. **61**:633, 1924.

The authors made determinations of the nonprotein nitrogen, urea, ammonia and uric acid of samples of blood and saliva taken simultaneously. The nonprotein of the saliva averages 37 per cent. of that of the blood, the ammonia plus urea nitrogen 76 per cent., the uric acid 40 per cent. and residual nonprotein nitrogen 12 per cent. Ammonia in the saliva comes largely from bacterial decomposition of urea. There are probably but very small amounts of amino-acid nitrogen in the saliva.

CHANGES IN THE HYDROGEN-ION CONCENTRATION OF THE BLOOD WITH COAGULATION. EDWIN F. HIRSCH, J. Biol. Chem. **61**:795, 1924.

It was found that rabbit's plasma became more alkaline on clotting (change of p_H of 0.09). The author suggests that a sudden change in carbon dioxid tension may aid in initiating the normal clotting of blood.

HIGGINS, Cincinnati.

ON THE GLYCOGENIC FUNCTION OF THE LIVER AND ITS ENDOCRINE CONTROL. W. CRAMER, Brit. J. Exper. Path. **5**:128 (June) 1924.

The author emphasizes that the glycogenic function of the liver is the dynamic one of secreting glucose into the blood, and not primarily the static function of glycogen storage. From the microscopic appearance of the liver cells of mice, he believes that those which received injections of insulin showed histologic evidence of decreased glycogenic function, and those which received thyroid extracts showed evidence of a stimulation of this function.

HOAG, New York.

STUDIES IN CALCIUM AND PHOSPHORUS METABOLISM. PART III. THE ABSORPTION OF CALCIUM AND PHOSPHORUS AND THEIR FIXATION IN THE SKELETON. S. V. TELFER, Quart. J. Med. **17**:245, 1924.

The author fed young dogs and rats varying amounts of calcium and phosphorus in their diets, and determined the excretion in feces and urine of these

two elements, in order to study the factors influencing their absorption and retention. He found that on a calcium poor diet the retention of phosphorus was low owing to high excretion in the urine, but that when calcium was added to the diet, in spite of a greater excretion in the stools, more phosphorus was retained owing to a reduction in urinary excretion. In both series, only a small portion of the calcium was absorbed. On the calcium rich diet the bones were normal, while on the calcium poor diet osteoporosis resulted and in one case changes in the bones resembling rickets. In explaining these results he advanced the idea that calcium would be precipitated in an alkaline medium as carbonate or phosphate, or else as soaps if the fatty acids were present, and that, therefore, calcium could be absorbed only in the upper part of the intestine before the intestinal contents became sufficiently alkaline, or before digestion of fats had proceeded far enough to cause precipitation. Absorption of calcium would therefore be deficient, and a large excess must be given to insure an adequate amount for the growth of bone. Phosphorus, on the other hand, is present normally in larger amount than calcium in the food, and it would be only under abnormal conditions, such as a low phosphorus together with a high calcium intake that phosphorus absorption could be deficient, owing to precipitation of calcium phosphate in the intestines.

JOSEPHS, Baltimore.

RESPIRATORY CAPACITY AND SITTING HEIGHT. R. MARINUCCI, Pediatria **32**:832, 1924.

Marinucci compared the sitting height and respiratory capacity in 960 children. Her conclusions are: (1) respiratory capacity increases with age; is greater in males than in females, also greater in the rich than in the poor; (2) there is a constant proportion between respiratory capacity and sitting height in children; (3) this study may be applied to advantage in the diagnosis and treatment of chronic respiratory diseases, in gastro-intestinal conditions and in postural defects.

DESANCTIS, New York.

Pathology, Bacteriology and Biochemistry

MASSIVE COLLAPSE OF THE LUNGS. GEORGE W. HOLMES, Am. J. Roentgenol. **11**:509 (June) 1924.

Massive collapse of the lung usually follows abdominal operation, even though only a local anesthetic is used, while aspiration pneumonia is the usual lesion following operations about the head and neck. The distinctive findings in the roentgenogram are a displacement of the heart and mediastinum toward the affected side and an elevation and fixation of the diaphragm on the side of the lesion.

Pasteur reported massive collapse following a paralysis of the diaphragm, and was able to demonstrate at necropsy in his post diphtheritic cases a collapsed lung on the paralyzed side without any evidence of disease in the lung. The condition is evidently not due to a plugging of the bronchi, and atelectasis is suggested as a better name.

STULIK, Chicago.

THE PRESENCE OF HYMENOLEPIS NANA IN PORTO RICO. ROLLA B. HILL, and AUGUSTIN SANCHEZ, J. A. M. A. **83**:766 (Sept. 6) 1924.

The authors are the first to report the presence of *Hymenolepis nana* in Porto Rico. The existence of this tape worm was discovered in the stools of three inmates of a boys' orphan home. This report indicates the widespread distribution of this parasite.

BONAR, Salt Lake City.

CHLORIDS OF SERUM, BLOOD, AND CORPUSCLES IN VARIOUS PATHOLOGICAL CONDITIONS. H. C. GRAM, J. Biol. Chem. **61**:337, 1924.

Using Van Slyke's method, the author determined the chlorid content of whole defibrinated blood and of serum from the same blood. The proportion of cells was determined by hematocrit readings. The average sodium chlorid content of blood from six normal subjects was 0.587 gm. per hundred cubic centimeters serum and 0.320 gm. per hundred cubic centimeters corpuscles. The chlorid concentration of the corpuscles does not vary according to the relative proportion of the cell volume of the blood. Tables are given showing the chlorid content of the blood in fourteen patients, the majority with anemia, polycythemia or edema.

A NOTE ON THE ESTIMATION OF CARBON DIOXID IN SERUM IN THE PRESENCE OF ETHER BY THE VAN SLYKE METHOD. J. HAROLD AUSTIN, J. Biol. Chem. **61**:345, 1924.

A method is described for the determination of the carbon dioxid combining capacity of blood serum by the Van Slyke manometric apparatus, when the serum contains ether. The principle of the method depends on the finding that if sodium hydroxid is added, carbon dioxid is firmly held by the alkali, while the ether is volatilized by vacuum and measured.

A STUDY OF A MILK-COAGULATING ENZYME OF SOLANUM ELAEAGNIFOLIUM. AARON BODANSKY, J. Biol. Chem. **61**:365, 1924.

The author studied an enzyme from the berry of the horse-nettle which will coagulate the casein of milk. The enzyme is most active at 80 C.

HIGGINS, Cincinnati.

MICROBIC VIRULENCE AND HOST SUSCEPTIBILITY IN PARATYPHOID-ENTERITIDIS INFECTION OF WHITE MICE. V. THE EFFECT OF DIET ON HOST RESISTANCE. LESLIE T. WEBSTER, and IDA W. PRITCHETT, J. Exper. Med. **40**:397, 1924.

Of two sets of female white mice from the same race and stock, one set was continued on the regular diet consisting of bread and pasteurized milk, supplemented by an oatmeal and buckwheat mixture and dog biscuit, and the other set was changed to the McCollum diet, consisting of whole wheat (67.5 per cent.), casein (15 per cent.), milk powder (10 per cent.), sodium chlorid (1 per cent.), calcium carbonate (1.5 per cent.) and butter-fat (5 per cent.).

Offspring of these animals after weaning were placed on the same diet as their mothers, and when grown to about 18 gm. were tested for their resistance to mouse typhoid bacilli, bichlorid of mercury and botulinus toxin. The animals receiving the McCollum diet were found to be more resistant to each of the foregoing agents than the animals on the regular diet.

THE INFLUENCE OF THE SUPRARENAL GLAND ON THE THYMUS. I. REGENERATION OF THE THYMUS FOLLOWING DOUBLE SUPRARENALECTOMY IN THE RAT. HENRY L. JAFFE, J. Exper. Med. **40**:325, 1924.

Previous workers have pointed out the occurrence of hypertrophy of the thymus and lymphoid tissues in animals after removal of the suprarenal glands. The present work was undertaken to obtain more specific and conclusive data on this point.

In sixty-six albino rats, reared from stock obtained from the Wistar Institute, both suprarenal glands were removed under ether anesthesia. Thirty-six of these animals died and thirty were sacrificed. The thymus glands were

weighed, and their weights compared with the tables for normal rats of the same age compiled by Donaldson for Wistar Institute rats. The thymuses of twenty-one controls not operated on were also weighed. In the animals which died, the weights of the thymuses with one exception fell below Donaldson's standards. Of the thirty animals killed from nine to two hundred and seven days after suprarenalectomy, the thymuses compared with the Donaldson standards as follows: In two killed by vaccine at nine days the thymuses averaged 11 per cent. above the standard. In one killed at twelve days, another at eighteen days the thymuses were 34 per cent. and 83 per cent. respectively above the standard. In two dying after struggle on the twenty-second day the thymuses averaged 125 per cent. above, one killed by vaccine on the twenty-fifth day had a thymus 38 per cent. above, one dying on the twenty-ninth day, from exhaustion incident to fighting had a thymus 30 per cent. above, five sacrificed from thirty to thirty-five days after operation had thymuses averaging 117 per cent. above, three killed forty-one days after operation had thymuses averaging 65 per cent. above, four at fifty-two days averaged 34 per cent. above, five at from sixty-five to seventy-five days averaged 40 per cent. above, one at one hundred and seventy days 88 per cent. above, three at two hundred and seven days averaged 16 per cent. above the Wistar standards. Of the twenty-one nonoperated animals, sacrificed while in good condition, the thymuses averaged 17 per cent. below Donaldson figures.

The author's conclusions are as follows:

1. Secondary hyperplasia of the thymus resulting in enlargement of the organ follows, with great constancy, double suprarenalectomy in adult rats.
2. The height of the curve of this enlargement is reached in from three to five weeks after bilateral suprarenal ablation.
3. The enlargement seems to take place more readily in the female than in the male, is not prevented by a previous pregnancy, and occurs even when the animal has lost weight after operation.
4. The enlargement of the thymus following double suprarenalectomy is believed to result from a disturbance of the interrelations between the gonads, the thymus, and the interrenal gland (suprarenal cortex).
5. A possible relationship between the enlargement of the thymus occurring in Addison's disease, exophthalmic goiter, status thymicolymphaticus, and that following double suprarenalectomy is suggested.

PERSISTENCE OF INSPIRED BACTERIA IN THE LUNGS OF ALCOHOLIZED MICE. ERNEST G. STILLMAN, J. Exper. Med. **40**:353, 1924.

In a previous paper on the presence of bacteria in the lungs of mice following inhalation, it was shown that pneumococci disappear within a few hours and without production of a general infection, while hemolytic streptococci persist in the lungs for a much longer period with frequent occurrence of septicemia. The present study has to do with the effect of alcoholic intoxication on the persistence of bacteria in the lungs and in the production of generalized infection.

Mice were allowed to inhale an atmosphere in which a fine bacterial mist had been produced by spraying a culture of the organism to be studied. Pneumococcus Type I, *Streptococcus hemolyticus,* and *Bacillus influenzae* were used. At intervals following exposure, individual mice were killed and small pieces of lung and a few drops of heart's blood were separately cultured.

The alcohol was administered either by inhalation of a spray or by intraperitoneal injection. The latter method was adopted after the first was found to give irregular results.

With inhalation of pneumococci none were found in the lungs of the thirty-six normal controls after four hours, and all the blood cultures were negative. In the eighty-seven alcohol intoxicated animals, the lung cultures were quite regularly positive during the first twenty-four hours and in one instance after five days. Fourteen had positive blood cultures.

A group of mice, fifty-four normal and 102 intoxicated with alcohol, were treated as before with pneumococci and kept under observation for at least fourteen days. Two of the normal controls died, both having pneumococci in the blood stream; fifty of the alcohol intoxicated animals died, forty-five of which had pneumococci in the blood.

Of the streptococci treated animals, in the thirty-eight normal controls the germs were found in the lungs of sixteen out of eighteen killed within six hours, but in only four of twenty killed from one to seven days after exposure: the hemolytic streptococci were demonstrated in blood in three out of the thirty-eight. In fifty-seven alcohol intoxicated animals, streptococci were recovered from the lungs in twenty-six of twenty-seven killed within twelve hours, and from seven of thirty killed from one to seven days after spraying; the organism was recovered from the blood of seven of the fifty-seven animals.

Of the animals inhaling *B. influenzae,* the organisms were recovered from the lungs of all the thirty-two normal controls killed within twenty-four hours after spraying, and of one of fourteen killed from the second to seventh day after exposure; the blood was positive in three cases. In the sixty-six intoxicated mice the bacillus was recovered from the lungs of all killed within twelve hours, and persisted longer than in the normal controls. The blood cultures were positive in sixteen.

McClure, Evanston, Ill.

The Effect on the External Parathyroid Glands of the Exposure of Rabbits to Ultraviolet Light. J. H. B. Grant and F. L. Gates, J. Gen. Physiol. **6**:635, 1924.

Daily exposure of rabbits to unfiltered ultraviolet irradiation produced a gain in weight of their external parathyroid glands, reaching a maximum of about 50 per cent. at the end of four weeks' exposure, following which a decrease in the size of these glands occurred even though the radiation was continued. The authors had access to the protocols of numerous nonirradiated rabbits, which served as controls for the known individual and seasonal variations in weight of their endocrine tissues. The microscopic sections of the external parathyroids removed from the irradiated animals showed that the enlargement was due to true hyperplasia and not to edema, hyperemia or fibrosis. The serum calcium of these rabbits showed no appreciable rise even at the height of the parathyroid hypertrophy.

The results of these experiments will undobtedly help in explaining the mechanism by which ultraviolet irradiation effects the cure of infantile tetany.

Some Researches Into the Action of Radium and Roentgen Rays Correlating the Production of Intestinal Changes, Thrombopenia and Bacterial Invasion. J. C. Mottram and A. Neave Kingsbury, Brit. J. Exper. Path. **5**:220, 1924.

When small laboratory animals were exposed to radium for the proper lengths of time, they developed thrombopenia and showed intestinal bacteria in the blood stream. Previous work had demonstrated that such irradiations interfered with the production of mucus, and bacteremia occurred even before the cells of the mucosa showed necrotic changes. The general bodily resistance of the animals to bacterial invasion was apparently not interfered with by the exposures used.

On Diphtheria Toxin and "Anatoxin," Their Flocculating and Immunizing Properties. G. Ramon, Ann. de l'Inst. Pasteur **38**:1 (Jan.) 1924.

The author used a special *in vitro* flocculating test to measure the amount of antigen in *B. diphtheria* cultures. He found that the toxicity of a culture to guinea-pigs increased steadily up to the ninth day at incubator temperature,

but after that it usually showed a steady loss. The antigenic value of the filtered cultures also increased over the same period of time and then remained constant at this level while the toxicity was lessening. He gave the name "anatoxin" to this antigenic but atoxic portion of the filtrate, and found that it gave as good results in the immunization of horses and guinea-pigs as did any sample of toxic filtrate.

"Encephalitizoon rabiei," the Parasite of Rabies. Y. Manouelian and J. Viala, Ann. de l'Inst. Pasteur **38**:258 (March) 1924.

By the staining method of Mann, it was possible to demonstrate in the brain and salivary glands of rabid animals the presence of a parasite, which from its morphologic resemblance to the microsporid found in spontaneous encephalitis of rabbits, was placed in the class of encephalitizoa. These parasites were usually intracellular and could easily be distinguished from Negri bodies. Although this morphologic relationship to rabies suggests an etiologic association, no biologic evidence has been adduced to substantiate it.

Vaccination of Cattle Against Tuberculosis and a New Prophylactic Method in Bovine Tuberculosis. A. Calmette and C. Guérin, Ann. de l'Inst. Pasteur **38**:371 (May) 1924.

By injecting calves under two weeks of age with cultures of tubercle bacilli, attenuated (BCG) by numerous transplants on a specially prepared potato medium, a relative protection was conferred which lasted not longer than the fifteenth month of age. During this time the animals gave a positive tuberculin test. Virulent tubercle bacilli which killed unprotected animals in two months caused no dissemination of the disease when injected in these vaccinated animals, although living bacilli were sometimes found in the lymph glands as late as twelve months after the inoculation.

Attempts at Antituberculosis Vaccination of Small Laboratory Animals by the Alimentary Route. A. Calmette, A. Boquet and Nègre, Ann. de l'Inst Pasteur **38**:399 (May) 1924.

Cultures of avirulent tubercle bacilli (BCG) were placed in the food of rabbits and guinea-pigs under 1 month of age. Three months later the same animals were fed virulent cultures, but the local lesions were very mild and late in appearance (some as late as six months), in contrast to control animals in which death resulted in 110 days for the guinea-pigs and a somewhat longer time for the rabbits.

Hoag, New York.

Blood Grouping in Infants. R. Politzer and S. Rapisardi, Pediatria **32**:858, 1924.

Politzer and Rapisardi, in fifty cases tested, noticed no agglutination of the mother's erythrocytes by the infant's serum; but in a few cases, the infant's erythrocytes were agglutinated by the mother's serum.

DeSanctis, New York.

The Theory of Disposition of Calcium in the Organism and Its Practical Significance. Carl R. H. Rabl, München. med. Wchnschr. **71**:468, 1924.

Rachitic deformities of the bones in children were treated by the administration of from 0.15 to 0.25 gm. of ammonium chlorid per kilogram daily. In addition, the extremity to be treated was subjected to stasis for about twenty hours a day. By these means the softening of the bone is obtained in a few weeks. The deformity can then by corrected, whereupon the treatment with

ultraviolet ray, phosphorus and cod liver oil and so forth with the addition of calcium is started. When the treatment with ammonium chlorid is started the children are kept lying down. The idea is to produce such a degree of acidity in the bones that the calcium is dissolved and carried off.

AMBERG, Rochester, Minn.

Nutrition

THE BACTERIOLOGY OF DIARRHEA IN INFANTS. WILBURT C. DAVISON, South. M. J. **17**:552, 1924.

Infantile diarrheas may be divided into two main groups, those of known etiology and those of unknown etiology. The first group contains only bacillary dysentery; the second is made up of all other instances of diarrhea.

Dysentery bacilli of the Flexner mannite-fermenting variety can be isolated in nearly 80 per cent. of all cases of bacillary dysentery. Less than 10 per cent. of the cases are due to infection with the Shiga bacillus. The blood serum will show dysentery agglutinins eight or ten days after the onset of the disease. Bloody or purulent diarrhea is practically always caused by infection with dysentery bacilli. It may be due to ameba in very rare cases. Bacillary dysentery is the only group of infantile diarrheas in which bacteria play a definite, primary rôle.

Infantile diarrhea, except bacillary and amebic, is not a primary bacterial infection but is a result of changes produced by external heat or some other causes, which may affect gastric acidity and motility or may reduce gastric and duodenal enzymes. As a result, undigested and unabsorbed food products are then fermented by the stool organisms, either in the small or large intestine. This fermentation yields irritating end-products which accelerate peristalsis and produce diarrhea. This irritation is a chemical rather than a bacterial inflammation. This explains why necropsy lesions may be absent in the intestinal tract.

MALNUTRITION OF SCHOOL CHILDREN. NOBLE D. MCCORMACK, South. M. J. **17**:841, 1924.

The most important measure for prevention of malnutrition in the school child is correct feeding during infancy.

Chronically infected or hypertrophied tonsils and adenoids are the most common physical causes of malnutrition. Early operation gives the best and most certain results.

The correction of faulty posture is always necessary and should be begun at an early age.

Many parents delay the care of children's teeth too long.

The author points out the fact that while malnutrition is most commonly seen in the child of school age, the conditions causing the malnutrition occur earlier in life.

If located early and properly cared for, many of the phases of malnutrition in later childhood can be prevented.

SCHLUTZ, Minneapolis.

A STUDY OF THE METABOLISM IN THE UNDERNOURISHED INFANT. FLEMING and HUTCHINSON, Quart. J. Med. **17**:339, 1924.

The authors studied a number of children who were suffering from what is variously designated marasmus, atrophy, athrepsia, etc., excluding so far as possible all those who had gastro-intestinal disease, infections or other ascertainable causes of their condition. From stool examinations the authors conclude that there is no defective absorption of fat, protein or total calories,

and they state their belief that the carbohydrate absorption is not at fault, though they have no figures on this point. In regard to metabolism after absorption, the authors find no failure to oxydize any of the absorbed food, and no increase in basal metabolism, but rather a decrease coincident with a decrease in weight. They give no figures on either of these two points but refer to work published elsewhere in support of their conclusions. They close this rather unconvincing study with the statements that "the metabolic picture in marasmus is identical with that of undernutrition from any cause" and that "marasmus is a condition brought about by inanition, and that in the vast majority of cases this inanition is caused by an insufficient diet, or by gastro-intestinal disturbance."

CONGENITAL PANCREATIC DISEASE WITH INFANTILISM. CECIL CLARKE and GEOFFREY HADFIELD, Quart. J. Med. **17**:358, 1924.

A girl, aged 4 years and 4 months at the time of her death, had suffered from fatty diarrhea possibly from the age of 5 months and had, in all probability from birth, passed stools containing an excess of fat. Her facial appearance and weight was that of a child aged 2, her height that of a child aged 3 years. The abdomen was distended, in part due to a considerable enlargement of the liver. The urine was normal. The stools averaged five per diem, were unformed, voluminous and pale; drops of fat were visible to the naked eye on the surface, and microscopically there were many fatty droplets but no fatty acid crystals. No improvement took place on a strict fat-free diet. She died of broncho-pneumonia following nasal diphtheria. Lying in the position of the pancreas was a shrunken-looking mass of fat, running through which was a thin strand of gland tissue containing many cell islets. The liver showed high grade fatty infiltration; the colon, chronic thickening and some ulceration.

JOSEPHS, Baltimore.

VITAMIN "A" AND ITS VARIATIONS IN COD LIVER OIL. J. DEAS, Canad. M. A. J. **14**:959, 1924.

This is a report of the comparative value in the growth promoting factor and the vitamin A in various specimens of cod liver oil.

McCollum and his co-workers, and more recently Goldblatt and Zilva, have found that the growth promoting factor and the antirachitic factor in cod liver oil are not identical but that, in cod liver oil especially, the measure of one usually indicates the amount of the other present. This is not true of spinach, which is high in the growth promoting factor but low in anti-rachitic factor.

A series of experiments by the author were carried out on rats, using a diet of casein 18 per cent., starch 53 per cent., lard 15 per cent., salt mixture 4 per cent., agar-agar 5 per cent. and yeast 5 per cent. Cod liver oil was fed after growth had stopped on the before mentioned diet. The potency was estimated by the amount required to produce normal growth.

Conclusions were that cod liver oils from Newfoundland were high in vitamin content, while other oils of Norwegian source were variable, and frequently low in vitamin content. A variation of at least 400 per cent. was shown.

MOORE, Omaha.

INFANT FEEDING IN THE TROPICS. Queens Hosp. Bull. **1**:6, 1924.

The Queens Hospital reports that the natives living on Fanning Island in the South Sea, feed their babies green coconut pulp and coconut water when the breast milk fails. They claim the coconut feeding is more common than breast feeding and that the mortality is very low. Only one specific case was reported with excellent results.

The following is a table showing an analysis of green coconut pulp which differs greatly from the table presented by Joslin, due probably to the fact that old coconuts were used in compiling the figures for Joslin's scale.

	Water	Protein	Sugar	Fat	Fiber	Ash
Green coconut pulp (firm)..	82.27	0.7	2.66	2.67	11.10	0.566
Green coconut pulp (soft)..	92.8	0.725	2.98	1.02	1.81	0.715

MINERALS

	H. T.		
Silica		K20	0.79
Iron	0.02	Na20	0.13
Calcium oxid	0.08	P205	0.42
Magnesium oxid	0.12	Cl	0.31
		S	Trace
		CO_2	Trace

In feeding coconut, the pulp, which is soft like jelly, is scraped out and beaten until it becomes liquid. It is then fed with a spoon as much at a time as the baby will take, and approximately every four hours.

BACON, Chicago.

IMPORTANCE OF ZINC IN THE FOOD OF ANIMALS; EXPERIMENTS ON MICE. G. BERTRAND and B. BENZON, Ann. de l'Inst. Pasteur **38**:405 (May) 1924.

Mice fed on food rigidly freed from zinc lived about from 50 to 75 per cent. as control animals to whose basal diet the minimal amount of zinc had been added. The survival method of study was necessitated, because the purified basal ration was lacking in known food factors.

HOAG, New York.

THE PATHOGENESIS OF NUTRITIONAL DISTURBANCES IN INFANCY. IV. EXPERIMENTAL DEHYDRATION AND ITS RELATION TO THE INTOXICATION PROBLEM. ERNST SCHIFF, H. ELIASBERG and W. BAYER, Jahrb. f. Kinderh. **106**:263, 1924.

"Thirst fever," according to the authors is probably due to a specific dynamic action of protein, since it did not occur from lack of water on a protein-free diet, but did occur when protein was included in the diet. The fever occurred in cases which showed a dehydration or concentration of the blood.

Several evidences were obtained of disturbed liver function in dehydration. Urobilinogen appeared in the urine after giving less than 3 gm. of bile orally, when accompanied by an insufficient water intake. Urobilinogen did not appear in the urine on a normal water intake, nor with a reduction of water, unless the water taken was insufficient. Amino-acid nitrogen in the urine was decreased on an insufficient water intake, though the total nitrogen was increased.

In some, the alkali reserve of the blood was somewhat decreased on an insufficient water intake. There was, however, no acetone in the urine, and there is no acetonuria in toxicosis.

The authors conclude that desiccation is an important factor in the pathogenesis of toxicosis. In toxicosis there is a definite disturbance in metabolic regulation, and they consider the disturbance of liver function to account largely for the symptom picture. They emphasize that toxicosis does not occur in normal children, but in children with a nutritional disturbance.

SUTHERLAND, Chicago.

THE NEW WEIGHT-HEIGHT TABLES AND MALNUTRITION. W. R. P. EMERSON and F. A. MANNY, Arch. Pediat. **41**:677, 1924.

The new weight-height tables, produced as a result of the efforts of the committe on standards of growth of children, which worked under the National Child Health Council, mark a distinct advance in method over those which

have been in use for a number of years, in that they were selected from data for 74,000 boys and 55,000 girls who had records of being "presumably healthy." When we return, however, to the children of school age it is clear that the greater part of the measurements have come from private schools, the members of which have decided economic advantages over those coming from families whose children attend public and parochial schools. Consideration should be given to this fact, for the authors have found that it is this social group of private school children which, throughout the country, shows the highest percentage of underweight for height. In the cities in which nutrition institutes have been held, and in which care has been taken to reach representatives of all social groups, it is usually the case that the children from the poorer homes reveal less abnormal conditions with reference to weight than is found among children of the well-to-do. Thus, while the new material marks an advance on what has been available in the past, it is important at this time to put on record its limitations. Four tables of weights and heights of children at various ages from birth to 18½ years are given.

THE USE OF INSULIN IN UNDERNOURISHED NONDIABETIC CHILDREN. O. BARBOUR, Arch. Pediat. **41**:707, 1924.

Since December, 1923, the author has administered insulin to forty malnourished children. The nutrition of 38 of these patients was benefited. No untoward results were obtained. The method used was to give the insulin subcutaneously, three units three times a day, twenty minutes before meals for children, aged 2 years and under. Over this age five units three times a day were given. Acutely ill patients were given one-half to one ounce of corn syrup by mouth twenty minutes after the insulin. Nothing else was given except liquids (water, milk, fruit juices). The chronic patients were permitted to eat as much food as they wished, of a diet with as low fat content as possible and high protein and carbohydrate.

VON MEYSENBUG, New Orleans.

RECTAL ABSORPTION OF VITAMINS. G. PETEINYI, Orvosi hetil. **68**:473, 1924.

Mashed potatoes may be given per rectum, and they do not cause any irritation even if the bowel movements are dyspeptic. The absorption of vitamin D from the rectum (and large intestine) is very satisfactory. In D-avitaminosis of babies, giving very small doses (5 gm.) of vegetables either per mouth or per rectum, produces cure and satisfactory development.

In this way we will also be able to study pathologic conditions as to the effect of vitamins, in patients in which the irritation of the stomach or intestines made the use of vegetables heretofore impossible.

EXPERIMENTS TO EXPLAIN THE PATHOGENISIS OF RICKETS. 1. THE BIOLOGICAL FUNCTION OF THE BONE MARROW. ANDRE BOSSAMYI, Orvosi hetil. **68**:531, 1924.

These are interesting and extensive experiments on rats, with the leading idea to clear up the question of the biologic function of the bone and bone marrow as a functional unit. The experiments were carried out so that whole bone marrow, fat of the marrow, marrow deprived of fat, watery extract of marrow were given to groups of rats fed on McCollum's ricket-producing diets and the results were registered and controlled on other rats.

The conclusions are:

1. The cause of the absence of calcium precipitation in rickets is the lack of the function of the bone marrow which produces the calcium precipitation under normal conditions.

2. The bone marrow, if functioning normally, produces and transmits to the tissues the organic factor, rendering them apt for calcium precipitation.

3. The factor may be extracted from the normal bone marrow also by water, but it is not identical with the enzyme found in the extract.

4. The rachitic bone marrow does not produce this factor.

Other experiments are to be published later.

ZENTAY, St. Louis.

Prenatal Conditions

THE PLACENTAL INFARCT AND ITS RELATION TO THE ETIOLOGY OF DEFORMED BABIES. JOHN E. TALBOT, Am. J. Obst. & Gynec. **7**:271, 1924.

The author presents twenty case histories and conclusions on many other cases, indicating the importance of acute and chronic infections during the prenatal period. He believes that these infections, principally chronic foci in teeth and tonsils, produce localized infections in the placental blood supply to the fetus. This may cause early partial separation of the placenta with consequent abortion. If the pregnancy progresses, however, and the infarction occurred at the time that some portion of the fetus is in active proliferation or budding, such part will be inhibited in its growth with a resultant malformation.

All the cases reported of deformed babies had placentas with evidence of damage within a radius of 1.5 inches (4.8 cm.) from the base of the cord.

ALLEN, Chicago.

THREE CASES OF CONGENITAL DUODENAL OCCLUSION. J. M. SMELLIE, Brit. J. Child. Dis. **21**:192, 1924.

Of the three patients cited, two died within a few hours of birth while the third lived for nearly three months.

The site of the occlusion in one child was just below the opening of the common bile duct, of which type twenty-three cases are on record. In the second patient, the occlusion occurred in the region of the duodenojejunal flexure, and of this type there are eleven instances on record. The third patient showed occlusion just above the opening of the common bile duct, but in addition there was a complete interruption of the continuity of the intestine, the second part of the duodenum apparently taking origin from the junction of the common bile duct and the pancreatic duct. No other instance of this type is on record.

The probable origin of these deformities is developmental. In addition, one patient had an imperforate anus and in another the gallbladder was absent.

LANGMANN, New York.

FURTHER OBSERVATION ON STILLBIRTH AND NEONATAL DEATH, THEIR CAUSES, PATHOLOGY AND PREVENTION. FRANCIS J. BROWNE, Edinburgh M. J. **31**:158 (Sept.) 1924.

The writer studied 200 cases in the three periods, antenatal, intranatal and neonatal deaths, with a subdivision as to the causes. In the antenatal group the most frequent cause was syphilis, in twenty-four out of sixty. A macerated fetus is usually presumptive evidence of syphilis. The pathologic condition of the liver is one of increased firmness (cirrhosis), while some syphilitic livers have a weight below or within normal limits, one-twelfth of the body weight, a liver weight higher than this usually means syphilis. The spleen of the normal fresh fetus has a 1:150 ratio to the body weight and any splenic weight over this is probably in a syphilitic fetus. The placenta of every

syphilitic macerated fetus is enlarged. The writer has examined the placenta with reference to its weight in syphilis compared with the normal, its paleness and increased thickness, the enlargement of the villi and the consequent destruction of their capillaries, the absence of red infarcts. He discusses the Wassermann reaction during pregnancy, and from 100 cases does not believe that the reaction is modified by pregnancy. Pregnancy in diabetes is rare and then ends frequently in abortion or a macerated fetus, and the cause of death is undetermined. The prevention of antenatal death is at present limited to syphilis and albuminuria.

In sixty-seven cases of intranatal death, all but four developmental and one infective were due to trauma, the largest number of these being from asphyxia. In a previous series of 200 cases, and in their later 200 cases, 400 in all, cerebral hemorrhage was found in ninety-one cases of intranatal and neonatal death. Hemorrhagic diathesis, breech delivery and prematurity are each responsible for a certain number of cases of hemorrhage, prematurity being seven times more likely to cause hemorrhage than causes found in infants at term. Hemorrhage in the premature infants is most frequent at seven to seven and one-half months. Intraventricular hemorrhage is absent in the full-term infant. The septums of the dura were injured in 18 per cent. Tears of the septums may or may not result in hemorrhage, while hemorrhage was found in some cases without injury to the septums. In the later series of 200 stillbirths and early postnatal deaths, there were fifty-four cases in which either tears of the septums, or cerebral hemorrhage, or both, occurred.

The writer advocates antenatal supervision for prevention of hemorrhage; avoidance of breech deliveries by external cephalic version at the ninth month of pregnancy; avoidance of difficult forceps deliveries by timely induction of labor, with avoidance of hasty delivery; limitation of induction of labor to patients reaching the thirty-fifth or thirty-sixth week of pregnancy. Intrapartum asphyxia is preventable in 75 per cent. of cases. Many cases of asphyxia can be prevented by induction of labor ten days before term. During the second stage of labor, intereference would save many infants from asphyxia, which is chiefly caused by primiparity and breech delivery.

In cases of stillbirth and neonatal death, there were nine which showed suprarenal hemorrhage, more frequently found in the right capsule than the left, explained on the basis of asphyxia damming back the blood in the inferior vena cava into which the right suprarenal vein empties directly, also by compression of the inferior vena cava between the liver and vertebral column in breech delivery where it is far more commonly found. Five infants born dead showed intranatal catarrhal pneumonia. Three deaths were apparently due to repeated doses of scopolomorphin narcosis for labor. Thirteen deaths were due to developmental causes, such as dropsy and hydrocephalus of fetus. In neonatal deaths, pneumonia was found in 33 per cent., the pathology varying from patches of catarrhal pneumonia to advanced gray hepatization with effusion.

This exhaustive study of fetal and new-born deaths is of interest chiefly to the obstetrician and the pediatrician, but the reduction in such deaths will be brought about through the general knowledge and influence possessed by the entire profession.

HYPERTELORISM, A HITHERTO UNDIFFERENTIATED CONGENITAL CRANIOFACIAL DEFORMITY. DAVID M. GREIG, Edinburgh M. J. **31**:560 (Oct.) 1924.

This is the Sir John Struther lecture, delivered by Greig at the Royal College of Surgeons, Edinburgh, presenting elaborate and numerous illustrations, made possible under a grant from the Carnegie Universities Trust. Two cases of what the writer has named hypertelorism are discussed, in which there is an unusual breadth of the nasal bridge, and to which certain of the

cases heretofore described as oxycephaly may belong. In true congenital oxycephaly, synostosis takes place at all the skull sutures, whether they are developed in cartilage or membrane. In hypertelorism there is no oxycephaly, for the sutures are all present and well formed and the deformity of the cranial cavity is entirely different from oxycephaly. Hypertelorism is an entity having a definite origin and course. It is dependent on a growth disturbance of a minute portion of the embryonic cranial tissue, following which certain deformities are produced. The volume and bulk of the brain grows uninterruptedly, but the functions are materially affected. Nasal bones of an unusual breadth are developed and an intrasutural bone is produced in the internasal suture. In the first patient described there were many abnormalities of the entire body, but the outstanding feature was the great distance between the eyes, and the great breadth of the lower part of the nasal bridge which was flat and the nose retroussé. Photographs of the girl at 7 and 16 years are given in the text. The child was mentally backward and generally retarded in growth. Both patients died early of tuberculosis. Excellent roentgenograms, photographs, sections and drawings of the skull are presented. The presentation covers thirty-three printed pages, and while the clinical entity is rare, this original communication offers something new in the field of abnormalities in which craniofacial peculiarities are predominant.

NEFF, Kansas City, Mo.

HEREDITY OF MALFORMATIONS. FRITZ-CARL LÜCKER, Monatschr. f. Geburtsh. u. Gynäk. **46**:327, 1924.

The author adds two family trees to those already recorded on the heredity of malformations, such as harelip and cleft palate. In addition, he discusses briefly the heredity of polydactylism. From the many articles he has consulted, he comes to the conclusion that these deformities are of definite mendelian heredity.

CROTHERS, Boston.

Diseases of the New-Born

INTRAVENOUS USE OF MERCUROCHROME IN AN INFANT AGED THREE WEEKS. W. G. CAMPBELL and F. T. CADHAM, Canad. M. A. J. **14**:858, 1924.

An interesting case history is presented of a baby, aged 3 weeks, who developed a staphylococcic infection of the umbilicus on the third day. The infection rapidly spread and multiple abscesses developed over the buttocks, generalized convulsions set in and the prognosis seemed hopeless. At this time 8 mg. mercurochrome (220 soluble) in 4 c.c. of distilled water was injected into the longitudinal sinus. Some improvement was noted on the following day. On the second day 12 mg. was injected and the improvement was very rapid. Cultures from the umbilical discharge were negative, the convulsions ceased and the baby made a complete recovery.

CONGENITAL DEFICIENCY OF SMALL INTESTINE. R. R. MCGREGOR, Canad. M. A. J. **14**:971, 1924.

The author reports a case of absence of the small intestine in what appeared to be upper part of the ileum extending for about 2 inches (5 cm.). An operation was performed (jejunostomy) but the baby died in a few hours.

MOORE, Omaha.

THE DIAGNOSIS OF CONGENITAL HEART DISEASE IN THE NEW-BORN, INCLUDING A RECORD OF CASES OF FETAL ENDOCARDITIS AND MALDEVELOPMENT. SYDNEY A. OWEN and A. NEAVE KINGSBURY, Brit. J. Child. Dis. **21**:161, 1924.

The authors cite two cases which illustrate some of the difficulties of accurate clinical diagnosis of a serious heart lesion in the new-born. The first patient, an infant, which died on the twelfth day, showed during life a forceful cardiac impulse, a loud blowing, rather coarse apical systolic murmur with maximal conduction to the left axilla, but no clinical enlargement of the heart. At necropsy, hypertrophy of the left ventricle, thickening and adherence to one another of the aortic cusps so that the lumen measured only 1 mm. in diameter, also an enlarged right ventricle and a pulmonary artery larger than normal, and thickening of the endocardium of the right auricle were found. Both foramen ovale and ductus arteriosus were patent. No evidence of maldevelopment was found. The authors infer that after birth the systemic circulation was practically maintained by the right ventricle through the ductus arteriosus, the stenosis of the aortic valve being such that only a very small quantity of blood could pass by this route. The enlargement of the right ventricle is thus explained.

In the second patient, an infant which died on the third day, the heart showed no abnormal signs clinically. At necropsy it was found that the aorta arose from the right ventricle and passed upward and to the left anterior to the pulmonary artery, which arose from the left ventricle. The foramen ovale was widely patent and the ductus arteriosus about 2 mm. in diameter.

It is difficult to be certain of enlargement of the heart in the new-born, where roentgen-ray examination and electrocardiographic tracing are not available. It should be remembered that in regard to the electrocardiographic examination of a healthy new-born infant, right sided "preponderance" is the rule and this lasts for several weeks.

The authors state it is certain:

1. That systolic bruits may be of a passing nature in the new-born.
2. That in some cases where the heart condition, as found at necropsy, presumably existed from birth, a systolic murmur takes time to develop.
3. That cyanosis sometimes, thrills nearly always and clubbing always takes time to develop.
4. That in infants and even children, a few months or years old, a persistent systolic murmur alone affords very questionable evidence of the presence of structural heart disease if the "tolerance" is good.

The authors have never heard diastolic murmurs in the new-born, nor the classical bruit of ductus arteriosus.

Heart failure in the new-born is difficult to diagnose with certainty. In the differential diagnosis of this condition must be considered:

1. Acute bronchopneumonia without fever.
2. Pulmonary atelectasis.
3. Cerebral hemorrhage.
4. Suprarenal hemorrhage.
5. Diaphragmatic hernia.

LANGMANN, New York.

THE EFFECTS OF BIRTH-TRAUMA ON THE BRAINS OF BREAST-FED INFANTS. BERNH. FISCHER, Schweiz. Med. Wchnschr. **54**:905, 1924.

The study was based on the systematic anatomic examination of about 500 brains of new-born, premature, and breast-fed infants. The brains of various animals were also studied. It was observed that intracranial hemorrhages were quite common, that they occurred in characteristic localities, and that in 65 per cent. the pathologic change was microscopic. The author gives a minute description of the pathologic histology, together with an exposition of a staining method which it was found necessary to evolve during the

research. Definite correlation was found between the microscopic findings and the age at which the infants died, namely, from 24 to 48 hours, from 2 to 4 days, from 6 to 8 days, from 8 to 12 days, from 2 to 3 months, from 3 to 18 months, and 18 months. Included in the study are cases of Little's disease, cesarean babies, idiots, cases of spontaneous nystagmus and acephalic monsters The reader cannot but be impressed with the care and scientific interpretation that the author exercised in his exhaustive study.

ELTERICH, JR., Pittsburgh.

HEMORRHAGE FROM THE UMBILICUS. BLOOD TRANSFUSION AS A REMEDY. G. SCHAANNING, Norsk. Mag. f. Lægevidensk. **85**:824, 1924.

The author describes seven patients with hemorrhage from the umbilicus, and discusses the etiology, pathogenesis and therapy. He does not find that congenital syphilis always is the cause, as has been thought before. Of these seven, two of the patients had congenital syphilis. These hemorrhages are not frequent. Of 15,500 deliveries in the ten year period, from 1914 to 1924, there occurred just the seven cases mentioned at the obstetrical department of the university clinic of Norway.

In one of the patients described, a blood transfusion from the mother had a lifesaving effect.

TOVERUD, Christiania, Norway.

Acute Infections

VAGINOSCOPY IN THE TREATMENT OF GONORRHOEAL INFECTION OF THE LOWER GENITAL TRACT IN INFANTS AND YOUNG GIRLS. L. M. RANDALL, Am. J. Obst. & Gynec. **7**:345, 1924.

The systematic treatment, outlined by the author, of the lesions in eleven cases of vulvovaginitis in children controlled the infection in all but one case.

Vaginoscopy revealed definite cervical disease in five patients, two of whom presented erosion of the cervix.

A diagnosis of gonorrheal salpingitis was made in one patient, a girl, aged 5 years.

ALLEN, Chicago.

OBSERVATIONS ON THE PRESENCE OF A TOXIC SUBSTANCE IN THE BLOOD AND URINE OF PATIENTS WITH SCARLET FEVER. JAMES D. TRASK, JR., and FRANCIS G. BLAKE, J. Exper. Med. **40**:381, 1924.

In seeking for evidence in support of the conception, resulting from the recent studies of Dochez, Mair, and Dick and Dick, that the general manifestations of scarlet fever are due to the absorption of a soluble toxic substance produced in the throat by a special type of *Streptococcus hemolyticus*, the authors endeavored to determine whether a specific toxic substance could be demonstrated in the blood and urine during the acute stage of scarlet fever. Samples of blood serum and urine from patients acutely ill with scarlet fever were injected intracutaneously in two groups of human volunteers, one group supposedly susceptible to scarlet fever, since their serums failed to blanch the rash of scarlet fever patients and the other group supposedly insusceptible, since their serums blanched the rash in scarlet fever patients.

The reactions obtained were studied with respect to size, duration, intensity of erythema, presence of induration, development of pigmentation, and the occurrence of desquamation.

Whenever a positive local reaction was produced by a sample of serum or urine the specificity of the reaction was controlled by a neutralization test

with a blanching serum, by the intracutaneous injections in a susceptible volunteer of two equal portions of the sample, one portion mixed with a blanching, the other with a nonblanchingg human serum.

The authors found that the intracutaneous injection of the scarlet fever serums into persons who had not had scarlet fever, and whose serums fail to blanch the rash in scarlet fever, caused a local reaction whereas there was no reaction with the control injections in persons whose serums blanch the rash of scarlet fever. Similar results were obtained with the injections of samples of urine in two out of five cases studied. They consider that the experiments support the conception that scarlet fever is a local infection of the throat by a particular type of *Streptococcus hemolyticus,* capable of producing a toxin which is absorbed and is the cause of the general manifestations of the disease.

McCLURE, Evanston, Ill.

A NOTE ON "SPASMODIC" DIPHTHERIA WITH TWO ILLUSTRATIVE CASES. G. W. RONALDSON, Brit. J. Child. Dis. **21**:182, 1924.

Occasionally instances of irritation of the nervous system occur in diphtheria, which may take the form of meningism or of pseudotetanic seizures. The following three groups are given:

1. No diphtheria membrane; clinical picture is that of an acute condition of the nervous system. No infective agent is demonstrated in the spinal fluid. Diphtheria bacilli can be cultivated from the saliva and nasopharynx. In this type symptoms abate rapidly after the injection of diphtheria antitoxin. However, evidence in favor of identifying this group with diphtheria is far from conclusive.

2. Cases of clinically definite diphtheria, though the clinical picture is colored by spasmodic nervous symptoms.

3. In this type signs of nervous irritation appear after disintegration of the false membrane (in one case after interval of three months).

Among the symptoms and signs found in these cases, Babonneix mentions the following as the most prominent: Trismus and opisthotonus, spasm and rigidity of hands, feet and even abdominal muscles, occasional hydrocephalic cry. The Kernig sign is absent. Except for an increase in pressure the spinal fluid is negative.

Two rather inconclusive cases are cited.

Ronaldson concludes that spasmodic nervous symptoms complicating diphtheria are rare and that it is doubtful if they occur in patients who have not suffered from a diphtheritic angina.

LANGMANN, New York.

THE SIGNIFICANCE OF THE SEROLOGICAL GROUPING OF HEMOLYTIC STREPTOCOCCI, WITH SPECIAL REFERENCE TO STREPTOCOCCUS SCARLITINAE. GEORGE H. EAGLES, Brit. J. Exper. Path. **5**:199, 1924.

All strains of hemolytic streptococci isolated from patients suffering from the same streptococcal disease showed their close serologic relationships by the specificity of their agglutination reactions with rabbit immune serum. This specificity was especially marked with *Streptococcus scarlatinae.* During convalescence from scarlet fever, the throat cultures showed a rapidly decreasing number of these specific hemolytic streptococci. The author suggests the following two possible explanations of this finding: (1) The *Streptococcus scarlatinae* may become covered up by the rapid development of other strains and (2) the accumulation of antitoxin in the tissues of the patient may cause a specific change in the agglutinogenic properties of the organisms. The significance of the latter suggestion is increased when we recall that Maloney and Hanna obtained analogous changes in the specific agglutinability of *B. diphtheriae* when they exposed it to diphteria antitoxin in vitro.

HOAG, New York.

GRAVE COMPLICATIONS PRODUCED BY VACCINATION AGAINST SMALLPOX. D. José VELASCO PAJARES, Pediat. Espan. **13**:142, 1924.

The report involves two brothers, aged 2 and 3 years respectively. Both children had been vaccinated. The reaction in one of them was very abnormal. A general vaccinia developed, spreading from an eczematous condition about the head and scalp. All the hairy portions of the skin became involved, and presented extensive suppurating areas and a condition which proved fatal twenty-one days after the vaccination.

The other brother presented a generalized vaccinia over the entire body, and a deep ulcerating lesion over the area of the primary vaccination. This ulcer extended down to the periosteum of the humerus.

The skin and underlying cellular tissue was entirely destroyed. The ulcer cavity was filled with pus and had deep red indurated margins extending outward for several millimeters.

There was another lesion on the face, beginning at the right buccal fissure to the point of the chin and partly down on the neck. The lesion was nonsuppurative and had become engrafted on an old impetiginous lesion of the face. It was an extension of the vaccinia. Pustular lesions spread over the rest of the face and over the trunk. The child recovered.

The author emphasized the danger of vaccination in any patient affected with eczema or any kind of skin lesion.

SCHLUTZ, Minneapolis.

WHOOPING COUGH PROPHYLAXIS WITH AUTO-GROUP VACCINES. ZOLTÁN V. BOKAY, Jahrb. f. Kinderh. **106**:301, 1924.

Prophylaxis with convalescent serum was without effect. Injection of vaccine made from a pure culture of the Bordet-Gengou bacillus protected 93.75 per cent. of 105 children. In those not successful, the Bordet-Gengou bacillus was not found in the sputum. The author concludes that some other organism may have been the causal agent. Then he adopted the method of making the vaccine from organisms cultured from the first case of whooping cough in the group. Of 161 patients inoculated in this way, only 3, or 1.86 per cent., developed whooping cough. For comparison, there were 108 patients exposed to whom vaccine was not given. Of these eighty-seven developed whooping cough.

Three injections of vaccine were given at four day intervals, injecting from 0.5 to 1.0 c.c., containing 30 million bacteria.

A CASE WITH CONGENITAL MANIFEST SYMPTOMS OF MORBUS WERLHOFF. KARL WALTNER, Jahrb. f. Kinderh. **106**:307, 1924.

An infant, whose mother had chronic Werlhoff's disease and was showing hemorrhages at the time of delivery, had subcutaneous hemorrhages at birth and for the first three days. The blood contained 90,000 thrombocytes per cubic millimeter. The coagulation time was ten minutes and the bleeding time twelve minutes. Development was normal and there had been no return of symptoms up to 7 months of age.

SUTHERLAND, Chicago.

CONCERNING FULL DIET IN DYSENTERY. LEO MENDEL, Monatschr. f. Kinderh. **28**:427, 1924.

The question of the effect of diet in dysentery has changed somewhat in the last years, owing to the introduction of quantitative besides qualitative factors. More recent developments have placed the index of the success of dietetic therapy in dysentery as well as in nutritional disturbances on the

weight curve rather than on the condition of the stool. The only danger is that, by improper diet, one might induce a nutritional disturbance on top of the infectious diarrhea.

In putting these ideas to experimental test, the author used the Moro mixture of butter, flour and full milk. In spite of the theoretic objections to such a mixture, a host of which can be raised, the results proved very satisfactory.

Previously this mixture had been used only during convalescence. The author, however, prescribed it right from the beginning and in full doses; i. e., in nurslings from 400 to 500 gm., and in older children from 500 to 750 gm. daily.

The beneficial effects of this diet on the stool is noticeable within twenty-four hours.

The children from the very biginning were given a quantity of food equal to that taken by a well child, and their weight increased immediately. In twenty cases treated this way, the ages varying from 3 months to 4 years, there were only two deaths, one in a badly syphiltic child with bronchopneumonia, and one who died the day following admission.

This treatment was tried during the fall and winter months. Whether it would be so successful during the heat of the summer, the writer says, remains to be seen.

CONCERNING THE TENDENCY TOWARD HEMORRHAGE IN WHOOPING COUGH. W. LASCH, Monatschr. f. Kinderh. **28**:441, 1924.

In a study of a whooping cough epidemic, the writer was able to show that the hemorrhages are not the direct results of the paroxysms. Indeed, in five patients hemorrhages occurred after the child had ceased coughing entirely, and in over half the series the hemorrhages occurred on the days when the child had only infrequent mild attacks. Probably the etiology lies in a toxic action on the blood vessels.

The feeding of orange juice with the idea of preventing an underlying scurvy had absolutely no effect on the hemorrhages.

GERSTLEY, Chicago.

ETIOLOGY OF HYDROPHOBIA. G. CARONIA and M. SINDONI, Pediatria **32**:817, 1924.

The authors inoculated fixed virus on the Tarozzi-Noguchi medium and incubated it under liquid petrolatum. They observed a slow development of minute, gram-positive cocci. Similar organisms were found in the brain of a child who died from hydrophobia and also of inoculated rabbits killed at the beginning of the paralytic stage.

CONGENITAL MALARIA. E. OLIVELLI, Pediatria **32**:959, 1924.

Olivelli reports a case of congenital malaria in an infant, aged 3 months, whose mother had malaria during pregnancy. The infant did not have an elevated temperature at any time but was pale, undernourished and had a slightly enlarged spleen. Olivelli quotes Laffont, who stated that congenital malaria is usually the result of the transmision of the tertian or quartan type of the disease, from an infected pregnant mother to her offspring.

DESANCTIS, New York.

TOXICITY AND TRYPANOCIDAL ACTIVITY OF BISMUTH SALTS INJECTED INTRAMUSCULARLY AND THEIR RELATION TO THE TREATMENT OF SYPHILIS. C. N. MYERS and H. B. CORBITT, Am. J. Syphilis **8**:578, 1924.

Intravenously soluble bismuth has high toxicity and low trypanocidal activity. After intramuscular injection, the soluble preparations are absorbed

more readily than the insoluble, though causing more pain. There was a great variation in the rate of absorption, so that toxic effects sometimes appeared from delayed absorption. Emaciation was one of the first symptoms. There was also evidence of destructive action on the kidney and liver, but no decided trypanocidal activity. The experiments were carried out by using large doses, in rats infected with syphilis.

SUTHERLAND, Chicago.

QUANTITATIVE STUDIES IN SYPHILIS FROM A CLINICAL AND BIOLOGICAL POINT OF VIEW. XV. EXCRETION OF ARSENIC THROUGH THE KIDNEY AFTER INTRAVENOUS ADMINISTRATION OF ARSPHENAMIN, NEO-ARSPHENAMIN, SILVER ARSPHENAMIN AND TRYPARSAMIDE. JOHN A. FORDYCE, ISADORE ROSEN and C. N. MYERS, Am. J. Syphilis **8**:619, 1924.

This is a continuation of studies to determine what becomes of the arsenic, since it leaves the blood stream a short time after injection. The excretion is closely related to the chemical composition. The group comprising atoxyl, arsacetin and tryparsamide are excreted rapidly through the urine. This group has produced injury to the optic nerve and should be used with caution. The group of arsenophenylglycine and arsphenamin are trivalent and are excreted largely through the intestinal tract. These apparently possess much the same mechanism of excretion as phenolsulphonephthalein and phenoltetrachlorphthalein.

Neo-arsphenamin (monosubstituted and disubstituted) is largely excreted through the intestinal tract, though with more excretion through the kidney than is the case with arsphenamin. Sulpharsphenamin and silver arsphenamin form a mixed group with a high excretion rate early, and later with excretion much the same as arsphenamin.

RETENTION AND ELIMINATION OF SILVER WITH SPECIAL REFERENCE TO SILVER ARSPHENAMIN AND SILVER THERAPY. C. N. MYERS and H. B. CORBITT, Am. J. Syphilis **8**:704, 1924.

After injections of twenty times the clinical dose of silver arsphenamin in rabbits, more than 90 per cent. is excreted in seven days. With clinical doses, the excretion is almost complete.

ON THE MECHANISM OF THE WASSERMANN REACTION. W. L. HARDESTY, Am. J. Syphilis **8**:744 and 760, 1924.

A modification of the Craig technic is described, which gives results unusually close to the expected in known clinical syphilis and apparently few false positives. In congenital syphilis Hardesty obtained 98 per cent. positive Wassermann reactions.

THE PROVOCATIVE KOLMER COMPLEMENT-FIXATION TEST FOR SYPHILIS. SIGMUND S. GREENBAUM and CARROLL S. WRIGHT, Am. J. Syphilis **8**:778, 1924.

When the Kolmer test is negative on the first examination of children born of syphilitic parents, provocative tests rarely aid in determining the presence or absence of syphilis. The provocative test is of value in some cases, particularly as a criterion of the persistence of the disease. A negative provocative test by no means excludes the presence of syphilis. The test was carried out by injecting from 0.15 to 0.03 gm. of neo-arsphenamin in children, and then making daily Kolmer tests on the three succeeding days and on the seventh day.

SUTHERLAND, Chicago.

Chronic Infections

THE EFFECTS OF ANTITUBERCULOSIS CAMPAIGN ON THE DIMINUTION OF THE MORTALITY FROM TUBERCULOSIS. ROBERT PHILIP, Edinburgh M. J. **31**:482 (Sept.) 1924.

After a lengthy discussion, comprising forty-four pages of this issue, Philip gives numerous tables showing the diminution of mortality from tuberculosis in Scotland in age groups, which is of especial interest from the pediatric standpoint. There has been for all ages in the last fifty years a reduction in deaths from all types of tuberculosis, on the basis of each 100 in 1871 to thirty-three in 1921; the age groups in childhood show a similar or marked decrease in number under 1 year, a reduction to eighteen, at 1 year to thirty, at 5 years, to twenty-nine, at 10 years to thirty-three. When pulmonary tuberculosis alone is considered, the reduction is even more striking. Under 1 year of age a reduction to ten on the basis of each 100 deaths in 1871, at one year to seventeen, at 5 years to seventeen, at 10 years to twenty-one. There is little difference in the sex incidence of deaths. According to the author, the organized fight against tuberculosis is producing most results in Scotland, England and the United States, and tuberculosis is "on the run."

NEFF, Kansas City, Mo.

THE VALUE OF THE FLOCCULATION TEST COMPARED TO OTHER SEROLOGIC METHODS IN THE DIAGNOSIS AND PROGNOSIS OF SYPHILIS. R. DEMANCHE and L. GUENOT, Ann. de l'Inst. Pasteur **38**:625 (July) 1924.

The flocculation test for syphilis was performed according to the method of Vernes (Presse méd., Dec. 3, 1921), using a reagent of fixed composition, and measuring photometrically the amount of reaction produced by the unknown serum. The test was apparently specific for syphilis. As a means of diagnosis it was found to be distinctly inferior to the Wassermann and related tests because of the smaller number of positives secured in primary, tertiary and latent syphilis cases. In the mutually positive reactions the flocculation had the advantage of allowing a measurement of the degree of reaction, giving some idea of severity, as well as the progress under treatment. It is to be emphasized, however, that the severity and the amount of flocculation do not run parallel. They recommend that the test shall not replace the standard serologic methods, but be used to secure complementary information.

HOAG, New York.

THE TRANSMISSION OF TUBERCULOSIS AND SYPHILITIC ANTIBODIES FROM MOTHER TO CHILD. M. L. RIBODEAU-DUMAS, Le Nourrisson **12**:175 (May) 1924.

In the studies on tuberculosis the antigen of Besreaka was used. In the first series there were six mothers suspected of tuberculosis, but only one was clinically tuberculous. The blood of all six gave a negative complement-fixation test. The bloods of three of the babies of these mothers were also negative.

In the second series eight women with proved tuberculosis, five containing tubercle bacilli in the sputum, all gave a positive reaction. The blood of seven of the infants was tested and gave a positive reaction in each case and the Pirquet test was uniformly negative.

An attempt was next made to find out for what length of time the antibodies continued to be present in the blood of infants giving a positive reaction at birth. It was found that the antibodies disappeared rather quickly, the time varying from one to three months.

These observations raise the question of whether children born of tuberculous parents possess a natural immunity, or whether they inherit a predisposition to tuberculosis. The author cites statistics showing that in families with tuber-

culosis, alcoholism or syphilis, the percentage of miscarriage, stillbirth and early death of infants is much higher than in families free from such taint. Even when babies born of tuberculous mothers are separated from this source of infection at birth, the mortality reaches 38 per cent. during the first month. This seems to prove that in spite of the presence of tuberculous antibodies in the blood at birth, these infants are more prone to develop tuberculosis early.

With regard to the transmission of syphilitic antibodies there is no unanimity of opinion. Some authors claim that pregnancy causes a disappearance of a positive Wassermann reaction in the mother, others hold the contrary opinion. In syphilitic babies the Wassermann reaction is often negative at birth, and may later become positive and vice versa. Fildes examined 1,015 infants in London. A positive Wassermann was obtained in only fourteen. Between two and six months 660 were reexamined. Of thirteen having a positive reaction at birth six had died and in the remaining seven the reaction had become negative. The only safe criterion to follow is that when a suspicion of syphilis in the parents exists, the baby should be given the benefit of anti-syphilitic treatment.

McClelland, Cleveland.

The Diagnosis of Occult Tuberculosis in Children. Kurt Schroeder, Med. Klin. **20**:1035 (July 27) 1924.

One thousand cases were studied in 1922 and 1923. Injections of old tuberculin were made in increasing doses beginning with 0.10 cm. of a 1:1,000 dilution and increasing the concentration to 1:10.

Two hundred thirty-five cases gave a positive reaction. Of these, 80 per cent. reacted to the 1:1,000 dilution, 16.2 per cent. to the 1:100 dilution, and 3.8 per cent. to the 1:10 dilution. Twenty per cent. of occult tuberculosis is missed when the tests are not carried to a higher concentration than 1:1,000.

Peterman, Rochester, Minn.

Serum Diagnosis of Tuberculosis in Childhood. Franz Mündel, München. med. Wchnschr. **71**:132, 1924.

Blood serum is obtained very carefully, and 1 c.c. is mixed with 5 drops of ammonium sulphate solution. After five minutes the mixture is inspected against a background, to determine whether any definite microscopic flocculence is present. Aside from active tuberculosis, only active lesions gave a positive result.

Amberg, Rochester, Minn.

Internal Diseases

Atelectasis as a Roentgen-Ray Sign of Foreign Body in the Air Passages. Willis F. Manges, Am. J. Roentgenol. **11**:517 (June) 1924.

True atelectasis is collapse and not obliteration of air space by exudate. Coplin differentiates "obturation atelectasis" of bronchial obstruction from "compression atelectasis" from external pressure. Some authors hold that the foreign body must obstruct the bronchus to both inspiration and expiration, while others state that the foreign body as a ball valve permits air to escape more readily than to enter.

In the presence of a history of aspiration of a foreign body and in the absence of any history of chronic infection of the lung or pleura, Manges believes that a collapsed lobe with displacement of the mediastinal structures to the affected side is positive evidence of foreign body whether the latter casts a shadow or not. In the absence of a history of aspiration it is evidence of

bronchial obstruction and if the appearance is not explained by some concurrent condition, he believes that a diagnosis of foreign body is strongly probable and a bronchoscopic examination is indicated.

The roentgenographic appearance is extreme density in the affected lung, displacement of the heart and mediastinum toward the affected side and elevation of the diaphragm on the affected side.

STULIK, Chicago.

CONGENITAL HYPERTROPHIC PYLORIC STENOSIS IN TWINS. HERBERT H. DAVIS, J. A. M. A. **83**:686 (Aug. 30) 1924.

The author reports the occurrence of congenital hypertrophic pyloric stenosis in twin boys. A Rammstedt operation was performed at the age of 28 and 34 days respectively, with the ultimate recovery of each child.

CONGENITAL ARTERIOVENOUS FISTULA. WILLIAM FRANCIS REINHOFF, J. A. M. A. **83**:743 (Sept. 6) 1924.

This very rare condition has been frequently confused with other congenital anomalies of the blood vascular system, such as aneurysm by anastomosis, cirsoid aneurysm, nevus maternus, pulsating nevus and venous aneurysm. The author suggests the use of the following classifications: (1) congenital venous aneurysm, (2) congenital arterial aneurysm and (3) congenital arteriovenous aneurysm. The last mentioned consists of two clinical types; in the first there is a lateral anastomosis formed by small vessels communicating between an artery and an accompanying vein; in the other there is a more or less direct, or end to end anastomosis between one or more arteries and a plexus of large venous sinuses. The close association of hemangiomas and congenital arteriovenous fistulas suggests a common etiology. The author has collected four cases from the literature and reports two more. The symptoms are often present at birth and usually in the first few years the physical findings become prominent. Although in some instances there is a systolic murmur over the precordium, there is no evidence of cardiac enlargement. The author reports the first case of arteriovenous fistula successfully operated on. It consisted of a fistula between the external carotid artery and the external jugular vein.

BONAR, Salt Lake City.

LOW NITROGEN METABOLISM WITH LOW CARBOHYDRATE DIET IN DIABETES. KARL PETRÉN, J. Biol. Chem. **61**:355, 1924.

Petrén studied the nitrogen intake and output over considerable periods (from twelve to sixty-one days) of time in diabetic patients on a low protein, low carbohydrate, but high fat diets. He found a smaller value than has previously been reported under any conditions for the protein quotient $\frac{\text{nitrogen excretion in grams} \times 6.25}{\text{body weight in kilograms}}$ when his patients received approximately 24 gm. protein, 45 gm. carbohydrates and 200 gm. fat. This finding is unusual, as previously carbohydrate has been considered very efficacious in sparing protein, whereas fat was considered much less so. When the carbohydrate was diminished to 20 gm. per day, the quotients were somewhat higher. Also some very low quotients were obtained when the total number of calories in the diet were low (from 1,300 to 1,600 per day).

HIGGINS, Cincinnati.

IDIOPATHIC APLASTIC ANEMIA IN A CHILD. G. HARVEY AGNES, Canad. M. A. J. **14**:859, 1924.

The author precedes the presentation of the case by a discussion of aplastic anemias as to etiology, diagnosis, frequency and treatment.

Anemias, besides being classified into primary and secondary anemias, should be classified according to the response of the bone marrow to the disease process. Most anemias show considerable response, but there are certain types in which there is no reaction on the part of the blood forming organs. These are the aplastic anemias. He further classifies the aplastic into secondary and idiopathic, depending on whether a cause can be discovered. Some of the regenerative types of anemia have transitory stages of aplasia. The etiology of the idiopathic type is unknown, some authors believing that the condition is due to a hemolysis with marrow exhaustion and others that it is due to a marrow deficiency similar to the aplastic anemia of Pappenheim.

Two factors are emphasized in the differential diagnosis. These are: (1) The lack of any of the regenerative type of red cells and the marked lymphocytosis, and (2) the finding of yellow bone marrow at necropsy. The differential findings from pernicious anemia, idiopathic purpura hemorrhagica, lymphoid and myeloid myeloma, and secondary aplastic anemia are discussed in detail.

The case history is that of a girl, aged 12 years, whose family history tells of a brother who had a severe type of anemia. Personal history shows nothing of importance. The main symptoms were increasing pallor with dizziness and lassitude, bleeding gums, minute retinal hemorrhages, and blood count of red blood cells, 1,200,000; white blood cells, 3,500; hemoglobin, 22 per cent. Polymorphonuclears, 8 per cent.; large mononuclears, 2 per cent.; small mononuclears, 88 per cent.; endothelial leukocytes, 2 per cent. There were no normoblasts or megaloblasts.

The course of the disease was very rapidly downward, the child dying in five months. Interesting points in the case were: the severe generalized hemorrhages, the fact that the patient's blood changed from Type 2 at one examination to Type 1 at another, and the severe destruction of the bone marrow noted at necropsy. Blood transfusions were used in the treatment but without any effect.

RENAL GLYCOSURIA IN AN INFANT TWENTY MONTHS OF AGE. ALTON GOLDBLOOM, Canad. M. A. J. **14**:950, 1924.

The patient was a boy, aged 20 months. His birth weight was 10 pounds (4.5 kg.), he was breast-fed for eight months, and then fed anything he would eat. At the onset of illness, eight weeks previous to examination, the child weighed 26 pounds (11.8 kg.). The present illness began with an ordinary upper respiratory infection with mild fever. This persisted for two weeks, and was accompanied by absolute refusal of food and vomiting and loss of 6 pounds (2.7 kg.) in weight.

Routine examination of the urine showed 1 per cent. sugar, and albumin and casts with traces of acetone and diacetic acid. Blood examination at the same time showed 94 mg. of dextrose per hundred cubic centimeters of blood. Twenty grams of glucose was given and two hours following, the blood sugar was 95 mg. per hundred cubic centimeters of blood.

Renal function tests showed that the uric acid, urea and creatinin excretion were normal.

The patient was put on full carbohydrate diet and improved. Six weeks after treatment the sugar gradually disappeared from the urine.

An interesting feature of the case was the fact that the father had a definite renal glycosuria. The other interesting feature was the age of patient, 20 months, the youngest previously reported in the literature being 6 years of age.

PNEUMOCOCCAL PERITONITIS. R. R. STRUTHERS, Canad. M. A. J. **14**:955, 1924.

In this interesting paper, the author discusses primary pneumococcal peritonitis and reports seven cases. McCartney and Fraser, of the University of Edinburgh, demonstrated by their experimental work with monkeys that the

most probable route of infection was through the female genitalia and only when the vaginal secretions were alkaline. They felt that a preceding vaginitis was necessary.

Struthers' cases seem to bear out the deductions of McCartney and Fraser, with the exception that he does not believe that a preceding vaginitis is necessary. The clinical reasons given for believing the vagina to be the portal of entry for the infection are briefly:

1. Primary pneumococcic peritonitis is a disease of the female only.
2. The peritonitis is primarily pelvic.
3. At early operation, only the pelvic peritoneum is infected and more particularly that apposed to the fimbriated ends of the fallopian tubes.
4. Cultures taken from various parts of the peritoneal cavity show more luxuriant growth from the lower part of the cavity.
5. Pneumococci obtained by direct smears from the cervix corresponds in type to that grown from the peritoneal cavity.

Primary pneumococcal peritonitis occurs most often in children, in girls between ages of 4 and 7 years. The author reports seven cases, all but one being between 4 and 11 years, the exception being a woman, aged 33.

The type of pneumococcus is given as Type IV. The treatment is early operation and drainage. The author feels that an important differential point in diagnosis is the signs of toxemia or septicemia and peritonitis, with a generalized but less marked rigidity of the abdominal muscles.

MEDULLARY HYPERNEPHROMA WITH CRANIAL METASTASES. D. B. LEITCH and H. M. VANGO, Canad. M. A. J. **14**:962, 1924.

A case is reported of a malignant medullary tumor, Hutchinson type, of the suprarenal gland. The patient was a boy, aged 5 years, who was previously healthy. The family history was negative.

The chief complaints on entry were of general pains about the body, weakness of six months duration, with gradually increasing pallor for four months. Physical examination showed the following salient points:

The child was poorly nourished, with definite proptosis of the left eye; secondary anemia with low degree of leukocytosis, white blood cells, 10,800, and roentgen-ray findings of new bone formation in the wall of the left orbit.

Numerous swellings appeared on the patient's head during the course of the disease, and he died two months after admission.

Necropsy showed:

1. Numerous hemorrhagic soft nonencapsulated tumor masses on external surface of skull beneath epicranial aponeurosis. A few extradural nodules were found on the inner surface of skull.
2. A hemorrhagic nodular mass, slightly larger than the normal suprarenal was found replacing each suprarenal gland.
3. The pancreas showed three similar nodules.

The histologic examination showed the structure of round celled sarcoma.

The interesting features of this case are:

1. The enormous extent of cranial metastases.
2. The small size of the primary tumor.
3. The bilateral involvement and similarity of the suprarenal tumors.
4. The absence of ecchymoses about the orbit, which is usually one of the first clinical signs of cranial involvement in these cases.

MOORE, Omaha.

A CASE OF TRICHINIASIS TREATED WITH NEO-ARSPHENAMIN. IB HANSEN, Ugesk. f. Laeger **34**:626, 1924.

The author quotes references and gives experimental evidence to show that intravenous injections of neo-arsphenamin are of value in the treatment of trichiniasis.

The first small dose of neo-arsphenamin given may cause a definite reaction, which is probably due to the death of the trichina and a liberation of their toxins. The successive repetition of small doses for two or three days, with equal periods intervening, showed a gradual decrease of eosinophilic leukocytosis and a marked general improvement of the patient.

The hope for a permanent cure lies in the continuation of the treatment over an indefinite period.

A Case of Hydatid Cyst of the Lung. J. Garcia Del Diestro, Arch. Españ. Pediat. **8**:281, 1924.

The condition occurred in a boy, aged 13 years. When first seen, he had been ill for two months with fever and some expectoration of bloody sputum. Physical examination and roentgen-ray examination revealed complete involvement of about three-fourths of the entire right lung. On exploratory puncture in the fifth interspace, a clear transparent fluid was found containing some leukocytes and a few red blood cells. No parasitic bodies were observed in this fluid.

Operative procedure was contemplated but shortly before preparations were complete, the patient was seized with a violent coughing attack accompanied by asphyxia, cyanosis, dyspnea and severe pain. Shortly after the onset of these symptoms the patient began to expectorate voluminous quantities of a greenish-yellow pus, tinged considerably with blood. Cavity formation resulted. The reaction of Weinberg used as a test for the presence of echinococcus proved negative at this stage of the disease.

The boy was discharged apparently cured, and with fairly clear lung findings from the standpoint of both physical and roentgen-ray examination.

Within a few months the patient again presented himself with renewed symptoms. This time both the reaction of Weinberg and the intradermal reaction for echinococcus were intensely positive.

Schlutz, Minneapolis.

On the Pathogenesis of Diabetes Insipidus. Leif Salomonsen, Acta Pediat. **3**:261 (June) 1924.

The experiments reported support the conclusion that the primary difficulty in diabetes insipidus is an increased permeability of the kidney for water, rather than an impairment of its concentrating function with resulting diuresis. A salt poor diet caused a great reduction in the salt excreted in the urine, but did not influence the diuresis. On a diet with excessive salt, a control case retained both sodium chlorid and water, while the patient with diabetes insipidus, whose kidneys could not presumably keep back water, quickly excreted the excess sodium chlorid. When pituitary extract was administered, the patient acted like the control, retaining both salt and water. The striking effect of an intercurrent fever was shown by the author's case. Diuresis ceased immediately and temporarily a highly concentrated urine was excreted. It seems more logical to suppose that fever increased water retention and excretion through the skin, rather than that it restored the power to concentrate in a damaged kidney.

Experiments with restricted fluid intake caused no appreciable reduction in diuresis, and illustrate how dehydrated such a patient may become in a few hours.

The remarkable curative effect of pituitary extract must be attributed to a direct action of this drug on the water excreting mechanism of the kidney.

Holt, Baltimore.

THE INFLUENCE OF THE REMOVAL OF GOITER TISSUE ON CRETINISM. SAMUEL CHAITAN, Schweiz. med. Wchnschr. **54**:894, 1924.

The author cites fifty-seven patients with cretinism in which goiters were removed; 60 per cent. showed no mental change after the operation, 23 per cent. showed mental improvement, while 16 per cent. appeared to have been made worse. The total white count was slightly lowered. There was a slight decrease in the number of polymorphonuclear leukocytes, and a slight increase in the number of lymphocytes. There appeared to be no correlation between the mental change and the altered blood picture.

ELTERICH, JR., Pittsburgh.

AN INTERESTING CASE OF ACUTE LYMPHATIC LEUKEMIA. HANS ULLMANN, and HERMANN WEISS, Deutsch. Arch. f. klin. Med. **144**:344, 1924.

A boy, aged 11, was admitted to the ear service with sudden onset of chills, fever (temperature, 106), and earache. Except for a purulent discharge from the right ear and a left spastic hemiplegia, physical examination was negative. Under observation, the spleen became enlarged, a generalized adenopathy developed, epistaxis and hemorrhages in the fundi occurred. The blood picture changed overnight from one typical of pernicious anemia (red blood cells, 1,500,000, hemoglobin, 28 per cent., white blood cells, 5,000, differential, normal; anisocytosis and poikilocytosis, polychromasia, normoblasts and megaloblasts, no abnormal white blood cells), to that of an acute lymphatic leukemia. Large cells with a small rim of basophilic cytoplasm, with a large nucleus containing one or two nucleoli and not giving the oxidase reaction predominated (lymphoblasts). The total white blood cells rose from 5,000 to 89,000 steadily. Biopsy of a lymph node confirmed the diagnosis.

The disease terminated fatally four months after the onset; the bone marrow and lymph nodes were characteristic, and contained the before mentioned cells in great number. The hemiplegia was explained by a pachymeningitis hemorrhagica interna.

LEUKOPENIC MYELOID LEUKEMIA. PAUL SZILARD, Deutsch. Arch. f. klin. Med. **144**:286, 1924.

After detailing two typical cases of aleukemic myelogenous leukemia with characteristic necropsy pathologic findings, in one of which the blood picture changed from the aleukemic to the leukemic variety under observation (3,800 white blood cells, rising gradually to 103,000), the author asserts that they are merely two stages of the same disease process. The leukopenic phase is due to a decreased resistance of the white blood cells and not to a toxic substance in the aleukemic blood, as evidenced by the following:

The isolated white blood cells were suspended for twenty-four hours in blood serum and incubated.

Leukemic serum, plus leukemic white blood cells showed a 31.4 per cent. reduction in the count.

Healthy serum, plus aleukemic white blood cells showed a 63.2 per cent. reduction in the count.

Aleukemic serum, plus aleukemic white blood cells showed a 65.8 per cent. reduction in the count.

Healthy serum, plus aelukemic white blood cells showed a 63.2 per cent. reduction in the count.

As the white blood cells increase in the blood, their resistance increases during the transition. Due to the decreased resistance of the white blood cells in the aleukemic stage and the consequent increased destruction, the uric acid content of the blood should be higher than in the leukemic stage. This was not found to be the case. The explanation of the discrepancy is not entirely satisfactory.

Besides the increased resistance occurring during the transition from the aleukemic to the leukemic stage, an augmentation of the overproduction of the white blood cells occurs as seen by the rapidly increasing splenomegaly and hepatomegaly, as well as the relatively higher percentage of young cells in the blood. Another factor may be an infection added which may change the picture from that of leukopenia to leukemia.

LEVINE, New York.

Nervous Diseases

AMYTONIA CONGENITA. GERALD R. ALLABEN, J. A. M. A. **83**:842 (Sept. 13) 1924.

Two cases of amytonia congenita were reported in the same family, and the history of another child, which died at the age of 6 months, was suggestive of the same condition. These two cases, and the possible third were in male children of the same family, whereas the female children of the same family showed no signs of the disease. The apparently familial character of the disease is of interest.

BONAR, Salt Lake City.

CONSIDERATION OF FAMILIAL DISEASE OF LOCOMOTION. ALFRED GORDON, M. J. & Rec. **120**:257, 1924.

The author discusses certain pathologic states that repeat themselves in several members of the same family, run an identical course and develop independently of exterior causes. Disorders that arise from outside sources, such as poliomyelitis, syphilis and congenital anomalies resulting from general or local diseases of the fetus, are not included.

Familial disorders are disorders of the germ plasma itself. They belong to the group of conditions that are governed by the laws of heredity.

Myopathies, Frederich's ataxia, familial atrophy of the cerebellum, muscular atrophy, myotonia, myoclonia, chorea and tremors are some of the disorders that are sometimes seen in some members of the same family.

In spastic paralysis of the lower extremities, some degenerative basis is usually present, either insanities, neurosis, or alcoholism, consanguinity or syphilis. Another type mentioned is a periodic or intermittent form of loss of power.

To sum up the present study of disorders of locomotion, we must admit that the subject is one of structural anomalies created by evolutional disturbances.

The knowledge of the laws of heredity and the biologic modifications, which are the resultant pathologic modification of the creating organisms is of paramount value from the point of view of eugenics.

KINBERGER, New Orleans.

THE TREATMENT OF EPIDEMIC ENCEPHALITIS. F. STERN, Med. Klin. **20**:1027 (July 27) 1924.

Stern has observed over 300 cases of encephalitis. He feels that in dealing with experimentally produced immunity, the most logical treatment consists in using convalescent serum. His most favorable results have followed treatment with convalescent serum. From 50 to 80 c.c. of the serum is injected intramuscularly. Twenty-seven cases (acute or subacute) were thus treated. One patient, having a severe, acute encephalitis with meningeal symptoms, died. The remaining patients showed immediate amelioration and had no sequelae. In untreated patients sequelae follow in 40 per cent. of the cases. Nonspecific serum gives results, but they are not striking and the percentage of cures is low. Rosenow's serum is classed among the nonspecific serums.

PETERMAN, Rochester, Minn.

THE USE OF SULPHARSPHENAMIN IN THE TREATMENT OF CHOREA. R. D. MOFFETT and C. H. SMITH, Arch. Pediat. **41**:657, 1924.

The use of arsenic in the treatment of chorea dates back to 1826, and for the last fifty years solution of potassium arsenate has been almost universally used for this condition. The method used by the authors is to place the child in bed for twenty-four hours, the next day they give an intramuscular injection into the buttocks of 10 mg. of sulpharsphenamin for each kilogram of body weight. This dose is repeated at intervals of five days for three doses. Nine patients have been so treated and of these five showed definite clinical improvement.

VON MEYSENBUG, New Orleans.

POSTDIPHTHERIC "CHOREA." MACDONALD CRITCHLEY, Brit. J. Child. Dis. **21**:188, 1924.

A case is described of a girl, aged 14, who was admitted to the hospital for faucial diphtheria. Antitoxin was given and after a stay in hospital of thirty-seven days, during which she made uneventful progress, she was discharged. After being well for four weeks at home she developed nasal speech and her near vision became blurred. A week later loss of power of the left arm and dragging of the left leg appeared. At the same time fidgety movements developed down the right side of the body, causing her to twist the trunk and toss her arm aimlessly about and make grimaces. These involuntary movements also involved the left shoulder to a mild degree. At no time was regurgitation of fluids through the nose noticed. Slight facial asymmetry was present, the right nasolabial fold being more marked than the left. Volitional and expressional movement was more pronounced on the right side than on the left. Palatal elevation was correct and a sluggish palatal reflex was elicited. There was slight incoordination of speech and the gait was of a squirming microkinetic type.

In his discussion of the case the author states that:

1. Against the diagnosis of chorea are the absence of anything in the past history to suggest rheumatic infection and the freedom from cardiac involvement.

2. Against the diagnosis of epidemic encephalitis are the absence of lethargy or delirium, the rapid return of the accommodation reflex and power of convergence, and the absence of catatonia, as well as the absence of temperamental change and sleep disorder.

The authenticity of the diphtheria attack is substantiated by the following:

1. Local paralysis of the soft palate.
2. Specific paralysis of accommodation.
3. Generalized polyneuritis.

LANGMANN, New York.

ON PROGRESSIVE LENTICULAR DEGENERATION (HEPATO-LENTICULAR DEGENERATION). GREENFIELD, POYNTON and WALSHE, Quart. J. Med. **17**:385, 1924.

The authors review the literature dealing with this condition, and describe a case, with clinical and pathologic findings, occurring in a girl, aged 15 years. They end the paper with a discussion of the part played by the lesions of the lenticular nucleus in the production of the characteristic tremor, rigidity and torsion spasm.

JOSEPHS, Baltimore.

PROTEIN THERAPY IN THE TREATMENT OF CHOREA IN CHILDREN. RAMÓ GÓMEZ FERRER, Arch. Espan. de Pediat. **8**:323, 1924.

Chorea is a disease of older children and is apparently due to specific and at times virulent agencies. In all probability the pathologic anatomy consists chiefly in an irritation of nervous tissue, such as the cortical sub-

stances and the gray nuclei, also in polyneuritis and endocardial lesions. The infective agent of chorea may also cause a pseudorheumatic syndrome which cannot easily be influenced by sodium salicylate therapy.

Susceptibility to the choreic infection so characteristic of childhood may also be observed at other ages, notably in the pregnant mother.

Cow's milk furnishes adequate and suitable proteins for the purpose of protein therapy. From 2 to 15 c.cm. are injected, generally on alternate days. It usually required from nine to sixteen injections to insure complete relief from symptoms, although the author reports one case in which three injections were sufficient and one in which twenty-one were required.

The age of the children ranged between 5 and 11 years.

A short, transitory febrile reaction, reaching sometimes 40 C. would frequently follow the injection. An increase of all nervous phenomena, including the choreic movement, ensued at first, due to the action of the proteins. This is followed by a marked decline or complete disappearance of all phases of excitation.

The choreic phenomena, such as incoordinate movements, paresis or aphasia, are often relieved after the first few injections.

The dosage can be increased where there is no prompt action. It is essential that the therapy be instituted promptly.

In refractory cases arsenical preparations can be added to the protein therapy; intradural injections of blood serum may be used and subdural injections of magnesium sulphate.

The author regards the effect of protein therapy as exceptionally certain and probably one of the best forms of treatment for difficult cases of chorea.

SCHLUTZ, Minneapolis.

CONCERNING THE FEMORAL REFLEX, A NEW SYMPTOM OF TETANY. PETANYI, Monatschr. f. Kinderh. **28**:494, 1924.

The clinical symptoms of tetany are somewhat indefinite. In spite of the multitude of clinical signs described, some cases present difficulties in diagnosis. The writer describes what he considers a new clinical test for the condition.

Children ill with tetany show the following reflex. If, with a percussion hammer, one taps the anterior surface of the thigh between the upper and middle thirds, the movements of the leg elicited are identical to those of the patellar reflex. Petanyi believes that this reflex is independent of the ordinary patellar reflex, and is due to hyperirritability of the nerves in this case of the femoral—and an analogy to the peroneal radial or Chvostek phenomena.

In a study of thirty-seven cases, this sign was as constant as any of the others usually described. In 240 control cases, it was found in only three.

GERSTLEY, Chicago.

DIFFERENTIAL DIAGNOSIS OF MENINGISMUS AND MENINGITIS IN CHILDHOOD BY SPINAL FLUID EXAMINATON. J. AMBROS, Orvosi hetil. **68**:471, 1924.

Meningismus is a condition very often met with in children in connection with different febrile diseases. It is important to make an early differential diagnosis. In practice, the normal mastic reaction is the most convenient as it gives the first exact indications, and differentiates very reliably between meningitis and meningismus.

Determining the chlorin and sugar content of the spinal fluid can be done easily. The values, especially the sugar content, will differentiate between purulent and tuberculous meningitis, the only drawback being that they do not clearly differentiate meningismus, and small errors in the titration produce great differences in the percentage figured.

The gold chlorid and mastic reaction very clearly differentiate between the two conditions. They are easily demonstrable and controllable, their drawback being that they require more time and the preparation of gold chlorid is more complicated.

In the last stage of tuberculous meningitis, the precipitation of euglobulins is characteristic. Also ciscumscript meningitis without clinical signs may be diagnosed through these reactions.

TREATMENT OF INFECTIOUS CHOREA WITH LUMBAR PUNCTURE. ENDRE TUDOS, Orvosi hetil. **68**:642, 1924.

Seven patients treated with the method showed great improvement in a short time.

ZENTAY, St. Louis.

Diseases of the Eye

PARINAUDS INFECTIOUS CONJUNCTIVITIS. E. A. WALDECK, J. A. M. A. **83**:765 (Sept. 6) 1924.

This form of conjunctivitis was first discovered by Parinaud in 1888, and since that time only a few cases have been reported. In this instance the patient, a school girl, aged 13 years, first presented signs of the disease by redness of the conjunctiva, tearing and adhesions of the lids, and by a purulent discharge in the morning, followed a week later by a swelling in the left preauricular regions, which finally involved the entire side of the face and neck.

The laboratory examination revealed no bacteria on culture or smear. Histologic examination of an excised follicle showed a simple hyperplasia. The leptothrix of Verhoeff, which has been found in many of the cases reported, could not be demonstrated. The entire clinical course of this case was about two months. It is interesting to note that a pet cat developed a similar affliction about two weeks after the onset of symptoms in the child.

BONAR, Salt Lake City.

Diseases of the Nose and Throat

A SUCTION APPARATUS FOR THE NASAL SINUSES. G. RENDTORFF RANDERS, Ugesk. f. Læger **39**:720, 1924.

A simple suction apparatus is described. This consists of a Marriotte flask filled with water; a rubber tube having at one end a nasal bulb and at the other a glass rod which passes through the stopper in the neck of the flask and reaches down into the water; and a glass tube passing into the liquid through a stopper at the bottom of the flask.

The principle on which the apparatus is based is the obtaining of suction by a vacuum created in the flask when the water is permitted to flow from the lower tube. Changing the length of the lower tube, or the depth to which the upper tube is immersed in the water of the flask will determine the strength of the suction.

SCHLUTZ, Minneapolis.

A CASE OF TRAUMATIC RETROPHARYNGEAL ABSCESS IN A BABY OF EIGHT MONTHS OF AGE. ENDRE TUDOS, Orvosi hetil. **68**:476, 1924.

A case of an acute retropharyngeal abscess caused by a thumb tack which was caught in the root of the tongue. Recovery after operation.

ZENTAY, St. Louis

MASTOID ADENITIS IN INFANCY. C. GAUME, Pediatria **32**:850, 1924.

Gaume has noticed that retromastoid adenitis is common in infancy, occurring in local conditions, in syphilis, in rickets and in malnutrition.

STUDIES ON THE ETIOLOGY OF OZENA. I. NASSO and U. TASSO, Pediatria **32**:1065, 1924.

In twenty-four cases studied, Nasso and Tasso succeeded in isolating from the nasal secretion and crusts a minute gram-positive nonmotile organism. Young rabbits inoculated with this organism either intravenously or locally in the nose developed a condition characterized by nasal secretion and the formation of crusts. An organism identical with that inoculated was isolated and cultured from the nasal secretions of the rabbits.

ROENTGEN-RAY THERAPY IN HEINE-MEDIN'S DISEASE. L. TURANO, Pediatria **32**:1081, 1924.

Turano reports thirteen cases of anterior poliomyelitis treated with radiotherapy. He states that the roentgen rays have a decided beneficial effect in this condition. The method used was the application of the rays as early as possible to the affected portion of the spinal cord; in other words, treatment was started as soon as paralysis was noted. Turano states that the action of the roentgen ray is twofold: (1) it has an antiphlogistic action, (2) it has a stimulating action on the motor cells not affected.

DESANCTIS, New York.

Diseases of the Skin

THE ROENTGEN-RAY TREATMENT OF KELOIDS. HENRY H. HAZEN, Am. J. Roentgenol. **11**:547 (June) 1924.

In treating a total of thirty-five lesions the author reports a cure in twenty-five instances. The chief risk is a secondary telangiectasia, especially after large keloids. Excision and secondary irradiation is probably a better method for treating these larger lesions. Small hard lesions and facial lesions are especially difficult to treat. Keloids in negroes are less readily treated than the lesions in white persons.

The telangiectasia is treated with water cooled quartz lamp light with obliteration of all redness, but at times with pigmentation residues.

STULIK, Chicago.

THE MANAGEMENT OF IMPETIGO CONTAGIOSA IN MATERNITY HOSPITALS. HARPER J. BLAISDELL, J. A. M. A. **83**:833 (Sept. 13) 1924.

The seriousness of this disease, which is of staphylococcic origin, is again emphasized, and particular stress is laid on the necessity of instituting proper measures for control when an outbreak occurs. All uninfected infants should be removed to another room and no babies should be allowed to come in contact with either the infected or exposed babies. Attendants in the infected nursery should also keep away from the other patients, operating room and delivery room. Furthermore, nurses handling mothers of infants with impetigo contagiosa should not come in contact with uninfected infants or their mothers. All clothes and linen should be laundered separately. Finally the nursery must undergo a painstakingly complete cleaning. Every article should be scrubbed and sterilized if possible and the walls repainted.

BONAR, Salt Lake City.

A Study of Eczema as an Allergic Phenomenon. Warren T. Vaughan, South. M. J. **17**:749, 1924.

The manifestations of eczema are expressions of an allergic disease.

The various types of eruption are evidences of sensitization.

The endermic skin test or so-called scratch method is preferable to the intradermal method. It is not so likely to give confusing false positive reactions.

The test should be read after one-half hour, after from four to six hours, and after twenty-four hours. Failure to observe mild or delayed reactions may result in erroneous negative conclusions.

In eczema, adventitious factors acting nonspecifically may excite specific reactions in sensitized persons.

Eczema is essentially a manifestation of an allergic imbalance.

This frequently explains the good results of nonspecific treatment.

Schlutz, Minneapolis.

Developmental Telangiectatic Hemorrhage and So-Called "Telangiectasia," Familial and Nonfamilial. F. Parkes Weber, Brit. J. Child. Dis. **21**:198, 1924.

The author refers to certain developmental telangiectatic conditions, usually associated with "pseudohemophilic" hemorrhages, the familial occurrence of which in his opinion is of great interest. He cites the following groups:

1. Telangiectatic epistaxis. In most cases the hemorrhages occur only from nasal mucous membranes, and in certain cases there seem to have been no obvious cutaneous angiomas or telangiectases.

2. Telangiectatic hemoptysis. Probably some cases of "essential hemoptysis" and of nasopharyngeal and tracheal bleeding are of this nature.

3. Telangiectatic hematuria. Angiomatous conditions may exist in one or more papillae or calices.

4. Telangiectatic hematemesis. It seems probable that some cases of bleeding from gastric mucous membrane without gross organic changes may have been of similar telangiectatic origin.

5. Telangiectatic bleeding from rectum. This may occasionally occur at an early age.

A Law Regarding the Distribution of the Depigmented (Leukodermic) Patches of Vitiligo, When They Are Superadded to Molelike Nevi. F. Parkes Weber, Brit. J. Child. Dis. **21**:202, 1924.

The author cites several instances in which he has observed pigmented moles surrounded by depigmented (leukodermic) areas of skin in apparently healthy children. He concludes that these are not invariably due to vitiligo but that occasionally they may be of the nature of what he terms a "leukodermic nevus," namely, due to circumscribed congenital absence of cutaneous pigment.

He states that in these cases they are concerned with some part of an as yet undefined law governing the distribution of pigment in the skin.

Langmann, New York.

Herpes Zoster and Varicella. Aldo Cividali, Rev. di clin. Pediat. **22**:699, 1924.

Cividali describes cases of herpes zoster and varicella occurring in his practice, which may be interpreted to indicate the existence of a form of herpes caused by the varicella virus.

Shipley, Baltimore.

ERYTHEMA NODOSUM AND TUBERCULOSOIS. SPONTANEOUS DISAPPEARANCE OF LUNG INFILTRATION IN ERYTHEMA NODOSUM. ERNST FAERBER and M. BODDIN, Jahrb. f. Kinderh. **106**:293, 1924.

In this series of twenty-three children with erythema nodosum, twenty-one had a positive tuberculin reaction. The others were tested repeatedly by different methods and always found negative. Therefore, erythema nodosum cannot be considered a tuberculous process. Of the twenty-one, two later died of tuberculosis. In eleven, no tuberculous focus could be found when examined at varying intervals from one to six years later. Eight children showed pathologic lung findings in the roentgen ray only, the percussion and auscultation being negative. There was a definite shadow from 2 to 3 cm. in diameter, extending out from the hilum, which ordinarily would be considered as a severe pulmonary tuberculosis. This shadow, however, disappeared without treatment, and two or three years later showed evidences of only a slight fibrosis.

The shadows in the lung may be processes of the erythema nodosum similar to those in the skin, and the tuberculous bronchial glands are a locus minoris resistentiae. In none of the patients was tuberculosis made active by the erythema nodosum. Such findings therefore should not give a bad prognosis.

SUTHERLAND, Chicago.

HERPES ZOSTER AND VARICELLA. LUCIE ADELSBERGER, München. med. Wchnschr. **71**:105, 1924.

An interesting observation where a case of herpes zoster gave rise to a small epidemic of chickenpox in a hospital is reported.

AMBERG, Rochester, Minn.

Surgery and Orthopedics

ROENTGEN-RAY TREATMENT OF BONE SARCOMA. MYRON B. PALMER. Am. J. Roentgenol. **11**:550 (June) 1924.

Roentgen-ray treatment of a malignant mixed giant cell sarcoma seemed to produce bone cell regeneration, but did not prevent metastatic growths in the lung. In the other case a post-traumatic tumor growth of the knee was treated periodically for twenty months with apparent cure. It was not decided, however, whether the tumor was a malignant or osteo-genetic sarcoma or a benign tumor.

STULIK, Chicago.

TREATMENT OF PROLAPSE OF RECTUM BY ALCOHOL INJECTION. ALAN BROWN and T. G. H. DRAKE, Arch. Pediat. **41**:716, 1924.

The procedure is as follows: The skin about the anus is cleansed by alcohol. The patient is given a general anesthetic. A needle, 3 inches (5 cm.) long is attached to a Luer syringe containing 1.5 c.c. absolute alcohol. The child is placed on its back, the needle is inserted at one side of the anus, one-fourth of an inch outside the junction of the mucous membrane and skin and just posterior to the middle line. With the finger in the rectum as a guide, the point of the needle is passed up along the rectum, and at a distance of from 2 to 2.5 inches the whole of the alcohol is injected, the needle withdrawn and the procedure repeated on the opposite side. The buttocks are then strapped together with adhesive tape. Three cases are reported, in two of which a cure was effected; the third patient died of bronchopneumonia.

VON MEYSENBUG, New Orleans.

THE TREATMENT OF INGUINAL HERNIAS IN YOUNG INFANTS. CHARLES L. ROSENBERG, J. A. M. A. **83**:686 (Aug. 30) 1924.

The author advocates the use of a truss, consisting of a triangular pad stuffed with absorbent cotton, to each corner of which there is attached a muslin tube about 1 cm. in diameter and 15 cm. in length, also stuffed with cotton.

To apply the truss, the pad is first placed over the hernia and two tubes placed over each iliac crest to be tied behind. The third tube is brought downward and backward between the thighs and tied to the other tubes. For a double hernia, two pads may be used. The advantages of this truss lie in its softness, washability and ease of applying. This truss is not recommended for older infants.

BONAR, Salt Lake City.

INFLAMMATORY DISEASES OF THE BREAST. ARTHUR J. PARKER, M. J. & Rec. **120**:314, 1924.

In reviewing the etiology we find that breast inflammations occur almost exclusively in nursing women, less frequently during pregnancy, in the non-pregnant and in early infancy, rarely at puberty in both sexes and in the adult male.

Of the nursing women the most frequently affected is the primipara.

In the acute forms of inflammation, the organisms most frequently found are the staphylococcus and streptococcus. Pneumococcus and colon bacillus have also been found. The *Spirochaeta pallida* and tubercle bacillus are occasionally responsible for the chronic inflammatory conditions.

A break in the continuity of the nipple or the skin covering the breast is the most common portal of infection. The author stresses preventive measures as the most important treatment of breast infections.

Care of the breast cannot be instituted too early. Breast pumps, nipple shields and any article coming in contact with the breast should be sterilized.

KINBERGER, New Orleans.

THE SURGERY OF THE KNEE JOINT. NATHANIEL ALLISON, Surg., Gynec. & Obst. **39**:409 (Oct.) 1924.

It is a frequent clinical observation that the extent of disease and destruction of tissue is far greater than the outside appearance of the knee would indicate. The old term "tumor albus" represents no definite pathologic entity. The long established fear of opening the knee joint has during the past resulted in a high percentage of mortality because of too late attack on the pathologic process. Goldthwait and Flint, about 1900, clearly demonstrated that knee joints could be operated on with practically no danger from outside infection and this conclusion was confirmed later by Power, Martin and Mitchiner.

The mechanics of the knee joint were designed for the four-footed animals, and this may account for some of the overstrains incident to weight bearing in the vertical posture. The source of nutrition for the articular cartilage is not definitely known but it is possible that it may be derived from the synovial fluid, capillaries in the subarticular bone, or those of the lateral capsule. When cartilage is injured it repairs by fibrous scar, as chondroblasts have no chondrogenetic power. The synovial lining varies considerably in structure in different parts of the joint and the synovial fluid is derived from the surface endothelium and also from certain deeper cells which discharge mucin into the loose connective tissue spaces when it is squeezed out by joint movement. In the subendothelial layer there is a delicate plexus of nerve fibrils, as shown by Fisher.

The articular cartilage forms a strong barrier to the progress of disease from the bones to the joints. Phemister has shown that in acute infectious

processes the cartilage is destroyed early at points of contact, and the remainder of the cartilage is later involved. Allison and Brooks have shown experimentally that whenever a joint is invaded by organisms virulent enough to result in the formation of granulation tissue the joint cartilage will eventually be destroyed. Ankylosis after resection of the joint occurs first by fusion of granulation tissue, then union of dense fibrous tissue, later metaplasia of fibrous tissue into fibrocartilage and finally direct transformation into bone. This takes place in dogs as early as 180 days, in man very much later. The decreased capacity for bone regeneration of the epiphysis as compared to the diaphysis may be accounted for by the absence of periosteum and the lowered osteogenetic power of the osteoblasts of the epiphysis.

Synovectomy in chronic arthritis cases has become well established as a surgical procedure since 1900. Since 1904 in a large series of such cases the author has obtained normal function of the knee in over 80 per cent. In the acute infections and the progressive disease processes, true conservatism consists essentially of an early accurate diagnosis. This may require in addition to careful examination of the joint, removal of tissue for section, cultures and guinea-pig tests. Phemister has pointed out that in acute infections the cartilage is attacked first at points of contact between femur and tibia, whereas in tuberculosis the areas free from pressure are earliest involved.

Gonorrheal infection of the knee fall into two distinct classes. One, the acute type with a swollen painful joint and high temperature. The other, the mild type without fever and a joint full of fluid. The former should be treated by arthrotomy, irrigation, removal of synovial lining and primary closure; the latter, by aspiration and injection of the fluid subcutaneously. Syphilis of the knee as a rule responds readily to specific treatment.

In a tuberculous knee the object of surgical treatment is the ankylosis of the joint, hence the operation must consist in removal of the barrier to ankylosis — namely, the articular cartilage. In children with early tuberculosis the wise plan is to operate early, remove the affected cartilage and thus promote early ankylosis. Growth of bones is not interfered with because the epiphyseal line is not encroached upon.

PRIMARY BLADDER TUMORS IN THE FIRST DECADE OF LIFE. CLYDE L. DEMING, Surg., Gynec. & Obst. **39**:432 (Oct.) 1924.

Since the development of the cystoscope, tumors of the bladder are being found much more frequently than before, but the number observed in infants and children still remains very small. The author has gathered data from sixty-four cases (infants), and was struck by the predominance of mesothelial neoplasms and the absence of epithelial growths. Most of them appear grossly as polypoid rounded elevations of the mucous membrane with a more or less constricted base. Over half of them are some type of sarcoma, and they are usually found on the trigone. The myxomas are more rare and are seen on the trigone near the urethral orifice, often protruding in the female at the vulva. They recur rapidly after removal but do not produce hematogenous metastases. The fibromyxoma is a slow growing, firm, pedunculated mass which is relatively benign. The true myomas, rhabdomas, fibromas and papillomas are rarely seen.

The chief symptoms are (1) hematuria of variable character, (2) pain, (3) difficulty in urination, including frequency, incontinence and retention, depending on the size and location of the tumor. The diagnosis should not present much difficulty, providing one makes use of the cystoscope and roentgen ray.

The course of these malignant tumors is generally rapid and progressive, rarely lasting beyond six months without surgical relief. Even with early diagnosis and wide early excision the mortality is extremely high.

MILLER, Chicago.

REPORT ON BLOOD TRANSFUSION WORK SEEN IN HOSPITAL FOR SICK CHILDREN, TORONTO, CANADA. G. KERR CROSS, Brit. J. Child. Dis. **21**:173, 1924.

Five hundred and sixteen transfusions are reported. These include 394 simple and 122 exsanguination transfusions.

I. Simple. (Technic used, syringe method.)

A. Indications and Results:

1. Gross hemorrhage, excellent.
2. Anemias of all kinds, excellent.
3. Shock of all kinds, excellent.
4. As preparation for operation in debilitated patients, good.
5. As a therapeutic measure in cases of marked debility, excellent.

II. Exsanguination Transfusion.

A. Indications:

1. Septicemias, namely, erysipelas.
2. Septicemias, suspected but not proved.
3. Intoxications. (*a*) Toxic stage of burns. (*b*) Acute intestinal intoxication. (*c*) Intoxication of known or unknown origin.

B. Results.

1. Erysipelas.	Nontransfused	Transfused
Under 1 year	Mortality 56 per cent.	Mortality 6.6 per cent.
Over 1 year	Mortality 8.6 per cent.	Mortality 0 per cent.

2. Acute Intestinal Toxemias: Mortality reduced one-half by transfusion.

Intraperitoneal transfusion of citrated blood. This is simply another form of simple transfusion. Its results are no better than the intravenous method, possibly not quite so good. Its advantages are:

1. Simplicity of technic.
2. The donor's blood can be stored in the refrigerator.
3. Though similar groups are preferable, there is no contraindication to the use of a universal donor.
4. It gives good results in cases of bronchitis, lobar pneumonia and bronchopneumonia where intravenous transfusions are contraindicated.

It is indicated in simple anemias of infants as from malnutrition, rickets or syphilis.

The best results seem to be obtained by the injection of 20 c.c. twice daily for five days.

ACUTE APPENDICITIS IN CHILDREN, ONE HUNDRED AND TWENTY CONSECUTIVE CASES. W. A. THOMPSON, Brit. J. Child. Dis. **21**:207, 1924.

Among the symptoms of appendicitis in children the author mentions the following three as of particular importance:

1. Pain. Early pain may be overlooked in the young child. The pain is mainly due to irregular peristalsis of the appendix. At first it is usually umbilical or diffused throughout the abdomen, later localizing in the right iliac fossa, lumbar region, etc.
2. Vomiting. This is present and usually early. If severe and continuous it denotes an obstructed appendix.
3. Localized tenderness. This is the most important evidence. The temperature is not of much clinical value. Sudden subsidence of symptoms may mean perforation.

In the differential diagnosis the following must be considered:

1. Pyelitis.
2. Acidosis.
3. Inflamed glands in the ileocecal region.
4. Basal pneumonia and diaphragmatic pleurisy.
5. Henoch's purpura.

The appendix was removed in all cases, except where the general or local condition did not warrant it.

Of the 120 patients, eight died. In all of these, perforation had occurred and general peritonitis set in.

LANGMANN, New York.

CONGENITAL DISTAL DISLOCATION OF THE ULNA. D. M. GREIG, Edinburgh M. J. **31**:373 (July) 1924.

The writer maintains that this bilateral, distal, ulnar dislocation to the dorsum of the wrist is congenital, is primarily due to instability of the distal radioulnar articulation, that all the other features, such as incurvation of the radial shaft, altered radial orientation and deflection of the hand are consequences of the ulnar displacement. While "Madelung's deformity" is probably the best of many of the names given in the literature, it is still unfortunate as it is not descriptive, and Madelung was not the first to describe the condition. An excellent photograph and roentgenograms are presented. He points out that the deformity is not due to rickets. There is no abnormality of the ulnar head, but the congenital defect is in its attachment to the radius, especially in the triangular interarticular fibrocartilage. The author's discussion is limited to the foregoing aspects of the deformity, with no reference to treatment.

NEFF, Kansas City, Mo.

SPECIFIC DRESSINGS, A STUDY OF LOCAL IMMUNITY. A. BESREDKA, Ann. de l'Inst. Pasteur **38**:563 (July) 1924.

The author recalls the fact staphylococci and streptococci possess very little true antigenic power, and their injection in the form of vaccines produces practically no antibody response. The filtrate from a culture, eight or ten days old, contains, however, a soluble, thermostable, inhibitory substance ("Antivirus") specific for the organism from which it was derived, and capable of retarding the germ's growth *in vitro* and to a lesser extent *in vivo*. Within twenty-four to forty-eight hours after the subcutaneous or multiple intracutaneous injection of such a filtrate, the animal exhibits a considerable increase in resistance to the corresponding organism injected locally. This result is much more striking when the filtrate is applied in the form of dressings to large areas of skin. The rapid development of protection indicates that the immunity is local and not dependent on the formation of antibodies. The method has been applied to man in the treatment of various local staphylococcus and streptococcus infections, using autogenous "antivirus." The results were very encouraging.

HOAG, New York.

ILEUS DUE TO MESENTERIC CYST IN CHILDREN. ROBERT SCHIRMER, München. med. Wchnschr. **71**:108, 1924.

A case report of a boy, aged 5 years, who had an ileus due to a mesenteric cyst.

THE TREATMENT OF PHIMOSIS IN CHILDHOOD. RODERICH SIEVERS, München. med. Wchnschr. **71**:158, 1924.

In childhood, one has to distinguish between the pathologic condition of an actual narrowing of the prepuce; which is the true phimosis and the physiologic condition of the epithelial adhesions. The latter do not give any cause for interference except where the secretion does not proceed unformly, so that stagnation of the secretion occurs and produces disturbances. If the separation of the adhesions is not done properly, it may lead to a secondary inflammatory phimosis. True phimosis has to be corrected surgically.

THE SOLUBILITY OF STONES OF THE PELVIS OF THE KIDNEY AND OF THE BLADDER IN MADDERED URINE. ADOLF BAUER, München. med. Wchnschr. **71**:206, 1924.

It is pointed out that the administration of madder leads to the acidification of the urine, and maddered urine favors the solution of some stones.

THE PREVENTION OF POSTOPERATIVE URINE RETENTION. STEN VON STAPELMOHR, München. med. Wchnschr. **71**:368, 1924.

The intravenous injection of 2 gm. of hexamethylenamin in 40 per cent. solution, sixteen hours after operation, prevented any postoperative urine retention in a large number of patients. (These results were obtained in the adult.) When given twenty hours after operation there was no effect. In only two cases did the urine become bloody after injection.

PRIMARY "SOLÄSTHIN" ANESTHESIA. HOSEMANN, München. med. Wchnschr. **71**:394, 1924.

"Solästhin" is methylene chlorid. If narcosis with methylene chlorid (CH_2Cl_2) is carefully carried out with proper precaution, it is very useful and has been tried by the author for the narcosis of children for as long as fifty minutes' duration. It may be used, together with local anesthesia of the skin, but in children never with morphin or scopolamin. Excitations have to be avoided. Incomplete analgesia was seen only in 4 per cent. of the cases. Solästhin cannot be used where complete narcosis is necessary.

AMBERG, Rochester, Minn.

A PECULIAR CASE OF ASPHYXIA IN A BREAST-FED CHILD DUE TO A CYST OF THE TONGUE. K. LEUW, Schweiz Med. Wchnschr. **54**:1004, 1924.

The author reports a case of asphyxia in a baby, aged 4 weeks. The mother had noticed previous to the fatal attack that the child would occasionally manifest choking spells when lying down. However, on raising the child up, all symptoms would vanish.

At necropsy, Professor Hedinger discovered a cyst of an excretory duct of a mucous gland at the base of the tongue. The tumor was dense, about the size of a cherry, semispherical and when the tongue slipped back, it came in contact with the epiglottis causing pressure at the aditus laryngis. In reviewing the literature, the author noted numerous instances in which tumors were found in this location. He therefore advocates that in cases of sudden death or instances in which there are repeated attacks of choking, this diagnosis be considered in differentiation from aspiration of a foreign body, enlarged thymus, atypical development of the thyroid.

ELTERICH, JR., Pittsburgh

Miscellaneous

ZINC STEARATE INSUFFLATION IN INFANCY. EDWARD SCOTT O'KEEFE, Boston M. & S. J. **191**:739 (Oct. 16) 1924.

Results are reported in six patients seen on the Children's Medical Service of the Massachusetts General Hospital. All Patients recovered, usually within seventy-two hours. The symptoms were those of bronchitis or bronchopneumonia.

Zinc stearate acts as systemic poison and local irritant to the delicate mucous membrane of the bronchi. Analogy is pointed out with the clinical picture of brassfounder's chill, due to inhalation of zinc gases. Immediate

treatment consists of removal of excess powder from nose, throat and stomach of infant. Subsequent treatment is symptomatic as in bronchopneumonia.

Reference is made to the fatal cases reported by Heiman and Aschmer (Am. J. Dis. Child. **23**:503 [June] 1922), and William Edmudson (J. A. M. A. **80**:105 [Jan. 13] 1923).

Gengenbach, Denver.

A Cardiovalvulotome. Claude S. Beck, and Elliott C. Cutler, J. Exper. Med. **40**:375, 1924.

The thickness of the valve and its fibrous and often calcareous condition with stenosis in chronic valvular disease indicate that a powerful cutting device, which will excise a piece from the stenosed ring and remove it from the circulation, is needed in order to give surgical relief.

An instrument intended for this purpose and the operative procedure are described. The efficiency of the instrument has been tested on the stenotic valves of hearts removed at necropsy. The instrument has been used on a series of thirty dogs, and in one patient; a case of mitral stenosis. Twenty-four of the thirty dogs survived the operation. Of the six operative fatalities, two occurred immediately after making the incision at the base of the anterior papillary muscle and before insertion of the valvulotome, one resulted from hemorrhage, and three followed excessive regurgitation due to the removal of too large a segment from the valve.

McClure, Evanston, Ill.

On the Bacterial Factor in the Etiology of Dental Caries. J. Kilian Clarke, Brit. J. Exper. Path. **5**:141, 1924.

Fifty carious teeth were examined bacteriologically, and from fourteen of the larger cavities was isolated the *B. acidophilus odontolyticus* described by McIntosh, James and Lazarus-Barlow. From thirty-six of the cavities the author cultured a pleomorphic, acid-producing streptococcus which was predominant over the other organisms in practically all cases. It was found in pure culture in some of the smallest, least exposed cavities. This organism has been named the *Streptococcus mutans*. Sterilized teeth placed in glucose broth cultures of this acid-producing streptococcus showed erosion of the enamel and penetration of the dentinal tubules in the course of from seven to thirteen weeks, even when the culture medium was changed daily to minimize the eroding effect of the general acidity. Under the same conditions the *B. acidophilus odontolyticus* caused only superficial erosions of the enamel.

An Investigation Into the Etiology of Dental Caries: II. The Histological Characteristics and Distribution of B. Acidophilus odontolyticus. III. Further Experiments on the Production of Artificial Caries. James McIntosh, W. Warwick James and P. Lazarus-Barlow. With a Note on the Production of Malic Acid by B. Acidophilus odontolyticus. E. C. Dodds, Brit. J. Exper. Path. **5**:175, 1924.

The authors have isolated from a considerable proportion of cavities in carious teeth two types of an acid producing bacillus similar to Moro's *B. acidophilus*. Type II can produce in glucose broth cultures considerable amounts of malic and lactic acids. In such broth cultures, sterilized teeth show points of enamel erosion and occasionally invasion of the dentinal tubules by the organism when left in the tubes for many weeks with change of medium at intervals of one week. Attempts to produce caries of teeth in vivo by implanting the organisms under bands and in drilled holes have thus far not been particularly successful.

Hoag, New York.

CARIES DENTIS. GUTTORM TOVERUD, Den norske tandlægefor. tid. **33**:426, 1923; **33**:509, 1923, and **34**:1, 1924.

In a rather extensive piece of work, the author has raised the question whether or not the diet has any influence on the development of carious teeth. He finds from histologic studies of guinea-pig teeth, where the animals have been on a scorbutic diet, a marked change in the pulp and the dentin. Chemical studies of analogous teeth show a diminution in the calcium and ash, and an increase in magnesium.

He has also studied the influence of a calcium poor diet on the teeth and bones of white rats. He has found a decrease in ash, calcium, phosphorus and magnesium in the front teeth (constantly growing). In the molar teeth (outgrown when started on the diet) he found a decrease in total ash, calcium and phosphorus, but an increase in magnesium. In the bones the changes were just the same as in the molar teeth. Metabolism studies on these rats showed a lower calcium retention and a higher magnesium retention than in control rats on a normal calcium ratio. Blood calcium averaged 6.5 mg. per hundred cubic centimeters.

The author finally emphasizes the value of the diet, as such, on the development and maintenance of good teeth. In the diet he especially lays stress on the content of calcium and vitamins.

TOVERUD, Christiania, Norway.

Society Transactions

CENTRAL STATES PEDIATRIC SOCIETY

Rochester, Minn., Oct. 30, 1924
Second Session

E. J. HUENEKENS, M.D., *President*

OBSERVATIONS ON THE PHYSIOLOGY OF THE LIVER. Presented by DR. F. C. MANN.

From study on the effect of removal of the liver in the dog the following conclusions were reached:

1. The blood sugar level is dependent on the liver.
2. The formation of urea is dependent on the liver.
3. The destruction of uric acid is dependent on the liver.
4. The liver is not necessary for the formation of bilirubin.

When the liver is removed there is an immediate and progressive decrease in the blood sugar level so that a few hours after hepatectomy the blood sugar is only 0.05 to 0.03 per cent. Associated with the development of the hypoglycemia, certain very definite and characteristic symptoms occur. These symptoms appear at a fairly definite blood sugar level. When glucose is administered to an animal with hypoglycemia, these symptoms immediately disappear and the animal is restored to normal until hypoglycemia again develops. The administration of glucose again restores to normal. If glucose is administered, as soon as the liver is removed, in suitable amounts to maintain the normal blood sugar level the animal does not develop the hypoglycemic symptoms but after a variable period of time, which is always much longer than if glucose had not been administered, another group of symptoms occur not similar to those associated with the hypoglycemia, and the animal dies following the development of the latter symptoms. In general, 0.04 gm. of glucose per kilogram of body weight per hour will maintain the normal blood sugar of a hepatectomized animal.

The liver is also essential for producing the hyperglycemias, not only the permanent, as that following removal of the pancreas, but also the transitory hyperglycemia following the administration of epinephrin, anesthesia and asphyxia. When the liver is removed in an animal having hyperglycemia due to removal of the pancreas, the blood sugar decreases but the hyperglycemic symptoms develop at a higher blood sugar level than in a normal hepatectomized animal. The administration of epinephrin does not produce a hyperglycemia in a hepatectomized animal. We also found that the hypoglycemic action of insulin is not dependent on the liver because it occurs after hepatectomy.

The presence of the liver is necessary for the formation of urea. When the liver is removed and the secretion of urine maintained, there is a marked decrease in both the blood urea and the urea excreted in the urine. If the kidneys are removed in a normal dog, the blood urea progressively increases whereas if the liver is also removed at the same time the nephrectomy is done, the blood urea remains the same as at the time of operation. If the liver is removed in an animal having a progressively increasing blood urea due to a previous nephrectomy, the blood urea level remains the same after the removal of the liver. We have not been able to obtain any evidence that urea is formed after removal of the liver.

The dog normally does not have any uric acid, or only a faint trace in the blood. Uric acid progressively increases in the blood or is excreted in

the urine in large amounts in the hepatectomized animal. Uric acid injected in a normal dog quickly disappears but it accumulates in the hepatectomized animal.

A pigment, which responds positively to all the accepted tests for bilirubin, appears in the urine, plasma and fat of the hepatectomized animal. The liver is not essential for the formation of bilirubin.

SPLENECTOMY IN CHILDHOOD. Presented by DR. W. J. MAYO.

The spleen is an organ about which very little is known. Among other functions we may consider it as a filter, which acts by filtering out of the blood current those elements which are no longer needed in the circulation. Twenty-seven splenectomies have been performed on children in the Mayo Clinic during the last nine years, without an operative death. Splenic anemia was the most common cause for removal of the spleen in this group. Next in number were the cases of hemolytic icterus. The spleen has also been removed in cases of sepsis, with beneficial results. Splenectomy for hemorrhagic purpura has been performed with excellent results.

The operation used at the Clinic follows the technic developed by Balfour. Aside from the careful operative technic outlined, the preoperative preparation of these patients is very important in the reduction of mortality.

POLIOMYELITIS. Presented by DR. E. C. ROSENOW.

Past work has demonstrated beyond doubt that poliomyelitis is due to a filtrable virus. Since 1916 a streptococcus has been constantly isolated, which appears to have etiologic significance in this disease. During the epidemic in Rochester in 1921 it was possible, through intracerebral inoculation of animals and by the use of serums, to isolate this same streptococcus, not only in cases of poliomyelitis but also in contacts and in persons not directly exposed to the disease. Moreover, it was proved absent one year later in all but three of forty-four persons who were found to be carriers at the time of the epidemic.

Since 1921 a precipitin reaction has been used in identifying various streptococci from poliomyelitis and encephalitis, and it has been found that glycerin and salt solution extracts of these streptococci react similarly when layered over the respective antistreptococcus horse serums. Feeling that some simple method of determining the presence of this streptococcus in poliomyelitis must be found, nasopharyngeal washings were tried and gave a precipitin test with the antipoliomyelitis horse serum.

The table gives the results of the tests made this year in Rochester and during the recent epidemic in Detroit.

Results of Precipitin Tests with Antipoliomyelitis Horse Serum

Groups	Number of Persons	Positive			Negative
		Mildly	Strongly	Total	
Poliomyelitis	79	23	42	65	14 (15 to 56 days)
Abortive poliomyelitis	8	3	4	7	1 (21 days)
Normal contacts	38	11	18	29	9
Miscellaneous diseases in Rochester	20	1	0	1	19
Detroit	20	7	6	13	7
Scarlet fever	21	4	1	5	16
Normal persons in Rochester	44	1	0	1	43
Detroit, adults	50	24	6	30	20
children	40	10	13	23	17

The technic of the test consists in making a nasopharyngeal swab through the mouth with a curved wire, getting well up into the pharynx, avoiding contact with the tongue. The swab is washed off in 2 c.c. of salt solution, removed from the wire, and the absorbed exudate pressed from the cotton by twisting it around a forceps pressed against the mouth of the test tube. The

cleared or slightly opalescent extract is allowed to run from a capillary pipet into tubes from 3 to 3.5 mm. in diameter, to a height of about 1 cm. An equal amount of serum is added in the same way, plunging the pipet again to the bottom of the tube, thus forming a sharply defined layer of contact between extract and serum. The tubes are incubated for from two to two ane one-half hours and a reading taken, then placed in an ice-chest overnight and a second reading taken. The readings should be made by artificial light in a darkened room, holding the tubes below the margin of the shade of a strong electric bulb (from 75 to 100 Watt), directing the eye into a dark background. The absence of a cloud at the point of contact of extract and serum is recorded as a negative reaction, and the presence of a cloud as a positive reaction. The degree of clouding is recorded by the usual method as +, ++, +++ or ++++.

HYPERTHYROIDISM IN CHILDREN. Presented by DR. HENRY S. PLUMMER.

Out of 5,000 cases of goiter seen in the Mayo Clinic since 1918, there were but thirty patients under 15 years of age. In this group, eight patients were under 10 years. The onset of exophthalmic goiter is somewhat earlier than the age of the patients indicates. One patient was aged 5 years when operated on here, but the history indicated that the condition had begun in the latter part of the third year.

Exophthalmic goiter in infancy is a pretty frank disease. Most of the patients have exophthalmos. Some become highly emaciated. Although the disease is intense, children endure it well. It is surprising to see children with high degrees of exophthalmos and hyperthyroidism playing and running around, and on the whole feeling well. They are nervous and irritable, and unable to stay in a constant position.

An interesting case of exophthalmic goiter in a young woman was described because of the atypical picture presented. Very little tremor was seen upon holding out the fingers. There was nothing in the history to make one think of exophthalmic goiter except that she had been growing nervous. She had had a small colloid goiter from childhood with a small adenoma. She had gained in weight and felt splendidly. There was no weakness. The diagnosis was based on the peculiar habit of posing, and constant change of position which she exhibited. The basal metabolic rate was found to be plus 57. This habit of posing is almost pathognomonic of the peculiar psychic state in exophthalmic goiter, and in children it may be the essential finding in establishing a diagnosis.

The use of iodin was stressed. Crisis is abolished by its use. At the Clinic, eight children with exophthalmic goiter have been operated on with no deaths resulting.

THYROXIN. Presented by DR. E. C. KENDALL.

Thyroxin was isolated ten years ago and five years ago its identification was finished. Nothing can be done with desiccated thyroid which cannot be done with thyroxin. For the last few years attempts have been made to manufacture thyroxin and to study compounds closely, to see if any light could be thrown on the problem of how it functions in the tissues.

Thyroxin is one of the compounds that carries on oxidation. Thyroxin, therefore, does nothing new to the body, but acts as a more efficient means of increasing the rate of metabolism. Iodin is needed in the thyroxin molecule, so that its action can take place under more efficient conditions. Thyroxin contains three atoms of iodin and they increase the power of the molecule to react.

DIABETES IN INFANCY AND CHILDHOOD. Presented by DR. R. M. WILDER.

The diabetes encountered in children is usually the most severe form. The onset is sudden, the course is rapidly progressive and death comes from

diabetic coma. A child, aged 11 months, was admitted to the hospital in a state of extreme acidosis and died the same evening, seven days after the appearance of the first symptoms of the disease. This was before the discovery of insulin. Insulin is so recent an addition to our means of combating diabetes that it is too early to attempt any conclusions as to how much can be expected of it.

From October, 1922, to August, 1924, forty-six patients, with diabetes, aged 12 years or younger, have been admitted to the Clinic. All but five of these have had insulin and there has been only one death in the group of patients treated with insulin.

Occasionally, but very infrequently, instances of benign glycosuria occur in childhood. It is a mistake to regard a low fasting blood sugar in an early juvenile case as of any favorable significance. Glycosuria in children must be regarded with extreme seriousness if instances of diabetes are noted in the patient's family. Also, if glycosuria has been accompanied by any diabetic symptoms, such as polyuria, a patient is probably a true diabetic, despite a low blood sugar, even if all symptoms have disappeared on relatively little dietary restriction. Furthermore, it is rarely justifiable to resort to a sugar tolerance test in one of these juvenile cases in order to prove the presence or absence of real diabetes. It is a far better practice to treat all the cases as being potentially severe.

The occurrence of infections in the diabetic patient is almost always heralded by the appearance of sugar in the urine, or by the intensification of an existing glycosuria. The usual cause of acidosis in well-treated diabetic children is a head cold or some other infection because of depression of the carbohydrate tolerance. Acidosis develops more quickly in children than in adults and leads more promptly to coma.

The dose of insulin used in treating a diabetic patient is determined by the amount of sugar which is to be metabolized or by the degree of acidosis to be combated. The buffer against overaction of insulin is much smaller in children than in adults, owing to the smaller blood volume. Consequently, children are extremely sensitive to overdosage and develop reactions to insulin much more easily than do adults. It is very difficult to maintain the balance between acidosis from inadequate burning sugar and hypoglycemia. Another difficulty in the management of diabetes in children is that we must feed an excess of calories and protein in order to provide for growth. In only one respect is the treatment of children more easy than the treatment of adults. Children on the whole cooperate more readily and are more apt in their own management.

SURGERY OF MEGACOLON. Presented by DR. W. E. SISTRUNK.

It has been found at operation that practically all patients with true Hirschsprung's disease present a common condition, that is, a dilated colon with tremendous hypertrophy of the bowel wall. This begins generally at the rectosigmoid and extends upward into the bowel for a considerable distance, the distance depending to a certain extent on the care that has been exercised in treating these patients medically. It is usually best to resect this dilated portion of the bowel and to destroy this rectosigmoid process, because the disease is caused by some unknown disturbance at this point. Children up to the age of 12 years should be given medical treatment and no radical procedure should be attempted up to that time. An intelligent mother can accomplish a great deal through the proper diet, enemas, oils and so forth.

In those cases in which surgery is indicated, appendicostomy or cecostomy is usually done, and large quantities of water injected with very satisfactory results. If something radical must be done in children, it should be resection of the bowel.

Before any radical operation is performed, preliminary treatment is always wise. Patients vary a great deal in regard to the amount of feces present.

Some contain a much greater accumulation than others. Efforts should be made to resect the bowel while it is empty, since large amounts of feces cannot help but affect the mortality. Children should be given many enemas and placed on a diet which will produce very little refuse. It sometimes takes weeks to accomplish complete emptying of the bowel.

The operation may be done in one stage, but results are better if done in two stages. The mortality, when the operation is performed in stages after careful preoperative preparation, is not more than 5 or 6 per cent.

ESOPHAGEAL OBSTRUCTIONS IN CHILDHOOD. Presented by DR. P. P. VINSON.

Since 1907, eighty-six patients, aged 15 years and younger, have been brought to the Mayo Clinic because of difficulty in swallowing, due to esophageal obstruction. This group does not include patients who have had foreign bodies impacted in the esophagus, and who may have had more or less dysphagia. An analysis shows that in thirteen patients the obstruction was due to cardiospasm, in six the stricture was congenital in origin, in one the cause was undetermined and in sixty-six a cicatrix was responsible.

Fifty-two of the cicatricial strictures were caused by the ingestion of solution of lye, three followed burns from hydrochloric acid, two were tuberculous, three were secondary to simple mediastinitis, two resulted from the healing of ulceration in the esophagus which had occurred during typhoid fever, one followed an attack of scarlet fever, one resulted from ulceration due to a foreign body, and two were presumably following the ingestion of some type of caustic.

Eight of the patients had had gastrostomies before coming to the Clinic, and four had the operation at the Clinic soon after admission. It is noteworthy that when a thread is used for a guide in instrumentation in any type of esophageal obstruction, particularly in cases due to cicatricial stricture, gastrostomy is usually a needless procedure. The operation increases the risk, makes prolonged hospitalization necessary and adds materially to the patient's discomfort.

One of the patients died following the intravenous injection of a solution of glucose, one died after a gastrostomy and six died following instrumentation, usually because of the splitting of scar tissue with rupture into a previously existing periesophageal abscess. In the majority of cases this accident cannot be prevented by any method of dilatation.

The patients suffering from cardiospasm were treated in the usual manner. Plummer's modification of the Russell hydrostatic dilator was used, with very satisfactory results. The cicatricial strictures were dilated with graduated sounds introduced on a previously swallowed silk thread, and normal deglutition was restored to fifty-eight patients. But little difficulty was experienced in introducing the thread, even in very small children. The thread technic so simplifies the passage of sounds that it deserves the most serious consideration on the part of those who are called on to treat these unfortunate patients.

ST. LOUIS PEDIATRIC SOCIETY

Oct. 24, 1924

GEORGE M. TUTTLE, M.D., *President*

THE QUARTZ LIGHT IN SKIN DISEASES. Presented by DR. JOHN ZAHORSKY.

This report is limited to the use of the quartz light in various skin diseases seen in his private clinic during the last two years. The most remarkable results have been obtained in erysipelas (six patients), all of whom recovered. The exposure was made once a day, beginning with one minute and increasing

to three minutes at a distance of 15 inches. The inflammation promptly subsided and the spread of the disease was checked after three or four exposures.

Another disease quickly cured by the quartz light is impetigo contagiosa. Local antiseptics were used only when the infected area was small, the light being reserved for patients showing disseminated lesions.

We have had good results in intertrigo, and eczematoid patches evidently of infectious origin. In the secondary infections of eczema the light has a marked drying effect on the lesions. The results in ordinary eczema were doubtful.

Three cases of ringworm of the scalp were cured by the quartz light. Epilation was hastened and the area of invasion checked.

One case of resistant psoriasis in a girl, aged 12 years, yielded to semiweekly exposures of the whole body. There was a slight recurrence after three months.

No marked effects were obtained in acne and furunculosis. The rays do not penetrate deep enough to check these diseases.

One case of epidermophyton seemed to be favorably influenced. Several cases of protracted ecthymatous sores yielded to the quartz light exposures.

We have not succeeded in destroying warts by the quartz light. Probably our technic was not adapted for this purpose.

Strong local exposure has succeeded in our hands in diminishing the size and discoloration of superficial nevi.

HELIOTHERAPY IN OSTEOMYELITIS. Presented by DR. MALVERN B. CLOPTON (by invitation).*

We have been much impressed by the favorable results of heliotherapy in chronic osteomyelitis. The improvement is owing to an increase in the patients' resistance, resulting after properly applied sunlight, and at Ridge Farm the forced feeding seemed to play a big part.

Heliotherapy is not used until the patients have passed the acute febrile stage, as high fever is always a contraindication to sun treatment. Fever in osteomyelitis may continue for some time after the major septic area has been drained, but it gradually recedes unless some focus remains unopened. It is therefore necessary to have all septic foci well drained, after which small sequestrums have a tendency to work themselves out of the tissues. This process is greatly hastened by heliotherapy. If there is a large sequestrum in a poorly drained bone cavity, this must be removed by operation.

Heliotherapy has not changed the plan of handling osteomyelitis patients during the acute period. Nor do we feel that this treatment should be the chief dependence in chronic cases, until the wounds are properly drained. We think that the healing of the bone cavity while it is actively infected is better treated by the Carrel-Dakin method.

A few of the patients, particularly those with the multiple lesions are slow in making a complete recovery and the wounds often harbor small sequestrums, which may have been suspected shortly after the primary operation, but for fear of disturbing healthy new bone, have not been removed. These small sequestrums come out much faster under direct sunlight, and the wounds stop discharging. The child's general condition improves at the same time, and the new bone rapidly becomes normal. This is to be expected, when one compares the rapid muscle development seen in these patients after exposure to the sun.

HELIOTHERAPY IN BONE TUBERCULOSIS.* Presented by DR. ARCHER O'REILLY (by invitation).

Rollier, at Leysin, has shown the value of heliotherapy in the treatment of joint tuberculosis. Heliotherapy is more successful in higher atitudes where,

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* Presented several patients.

* Illustrated by lantern slides.

as the air is cleaner, a greater number of violet rays reach the patient. It can be used with benefit, however, wherever the air is clear.

Heliotherapy improves the general condition of the patient, and seems to have a direct curative influence on the diseased joint and the surrounding tissues. The muscles develop and become firmer, and the general condition improves. Motion is increased. Rollier shows some very remarkable results.

All the joint tuberculosis patients coming to the St. Louis Children's Hospital are treated at Ridge Farm, a branch of the hospital twenty miles out in the country. Here the regular routine of Rollier is followed. The children are exposed two hours twice a day, in the morning and afternoon in summer, and at midday during the winter. Exposure in winter is possible if the patient is protected from the wind by a screen about the bed. In summer, when not receiving sun treatment, the patients are given air baths. Rollier emphasizes strongly the importance of air baths. Patients also sleep on the porch and are only taken into the house to eat and to be bathed.

In addition to heliotherapy, the patients are given the regular routine treatment for joint tuberculosis. The great majority of patients suffer from tuberculosis of the spine and hip, and most of these are bed patients. The joint is immobilized by the use of a Bradford frame, in patients with tuberculosis of the spine, and by a frame and traction in hip cases. In baking, the patients are on their backs half the time, and on their faces the other half. The affected joint must be carefully immobilized.

The patients who are up are allowed to be about, supported by braces. Plaster and other jackets are not used, as they would interfere with heliotherapy and air baths.

At Ridge Farm the results have been similar to those of Rollier. The children have become well pigmented. One patient who did not pigment last year did not do well. This year there was a decided improvement in the amount of pigment, and also in the general condition. Weights increase and the muscles become firm, in spite of the fact that the patients have been in bed for many months. Atrophy is practically absent. Shortening is slight. In tuberculosis of the spine the kyphos does not increase; hemoglobin and red cells increase. Motion in the hip increases, but only if careful immobilization of the joint is maintained.

Heliotherapy is one of the best aids in the treatment of joint tuberculosis, and should be used whenever possible. An institution is not necessary for the treatment, but wherever sunlight is available; it can also be administered at home.

SENSITIZATION TO SUNLIGHT.* Presented by DR. SAMUEL E. POND (by invitation).

Sensitization to sunlight is but a special case of the absorption of radiant energy, whereby the sun's rays are converted in living tissues into energy of stimulating value, if available in sufficient quantity in a brief enough period of time. Certain portions of the spectrum are not absorbed by the tissues themselves, but may induce physiologic effects if absorbed by even a foreign substance (eosin, porphyrin, for example) in intimate contact with the tissue cells. Photodynamic sensitizers are ineffective if previously exposed to the light. Only those sources of radiation which emit energy of frequencies within the range of the absorption band or bands of the sensitizer can be effective. In the case of the sun we know of no gaps, there being a continuous spectrum from infra-red to ultraviolet.

Of the sun's light only infra-red and ultraviolet are absorbed in appreciable quantity by living tissues. Ultraviolet is absorbed by skin and cornea, presumably wherever the proteins containing tyrosin and tryptophan exist. If a

* Presented with explanatory charts.

compound like hematoporphyrin be in contact with the tissues and exposed to visible (violet) light, marked edema of the radiated area results.

It is not because the sun has more energy in the ultraviolet region that this portion of the spectrum has stimulating value, but because the specific absorbing compounds in the tissues are very efficient. With respect to the sun and the mercury vapor quartz lamp, most of the energy is in the infra-red region, and absorption by the skin is not limited to the portion physiologically most efficient. For greatest efficiency, sensitizers must be adjusted to the radiating source. In such a manner the handicap of absorption of ultraviolet by window glass can be overcome, and radiation therapy can be carried on indoors.

Infra-red is most rapidly and directly converted by the tissues, particularly pigmented, into heat; actinic rays, and much of the radiation absorbed by sensitizers is directly converted into chemical energy. The effect of the heat is chiefly to increase the rate at which chemical reactions proceed, and must always be taken into consideration in heliotherapy.

Limited regions of the spectrum may be selected by appropriate choice of filters placed between the source and the area to be radiated. In this way, specific reactions of definite character are more likely than under our present scheme of radiation by the quartz lamp or by sunlight outdoors. On a successful biophysical analysis of edema, erythema, pigmentation, radiation calcification, and other predominantly radiant energy transformations in living tissues, will depend not only a knowledge of certain essential physiologic phenomena, but also an extension of heliotherapy with more assurance of success.

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